



# Kaloko-Honokōhau National Historical Park

## *'AI'ŌPIO FISHTRAP DOCUMENTATION*



**'Ai'ōpio Fishtrap Documentation  
Kaloko-Honokōhau National Historical Park  
SRC Technical Report Number 24  
PMIS #98241**

a product of the

NATIONAL PARK SERVICE SUBMERGED RESOURCES CENTER



**'Ai'ōpio Fishtrap Documentation**  
**Kaloko-Honokōhau National Historical Park**  
**PMIS #98241**

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Technical Report  
Number 24

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# TABLE OF CONTENTS

LIST OF FIGURES .....	iv
LIST OF TABLES .....	vi
EXECUTIVE SUMMARY .....	1
INTRODUCTION .....	1
PROJECT GOALS .....	4
METHODOLOGY .....	4
GPS and PhotoLink Documentation .....	6
Site Mapping .....	8
RESULTS .....	9
Maps and Drawings .....	9
Cross Sections .....	14
Volumetrics .....	29
CONCLUSIONS .....	34
BIBLIOGRAPHY.....	36

## LIST OF FIGURES

1.	Location map of Kaloko-Honokôhau National Historical Park .....	2
2.	Aerial view of the ‘Ai’ôpio Fishtrap .....	3
3.	GPS unit base station .....	5
4.	Caputuring GPS point 026 underwater .....	6
5.	GPS documentation of intact wall .....	7
6.	Flagged base stones in wall cut .....	8
7.	Mapping profile of intact wall section .....	9
8.	Planimetric view of ‘Ai’ôpio Fishtrap wall .....	10
9.	‘Ai’ôpio Fishtrap map showing locations of profiles and cross sections .....	11
10.	Detail drawing of wall cut section .....	12
11.	Profile #1 .....	13
12.	Profile #2 .....	14
13.	Cross section 1 .....	15
14.	Cross section 2 .....	16
15.	Cross section 3 .....	17
16.	Cross section 4 .....	18
17.	Cross section 5 .....	19
18.	Cross section 6 .....	20
19.	Cross section 7 .....	21
20.	Cross section 8 .....	22

21.	Cross section 9 .....	23
22.	Cross section 10 .....	24
23.	Cross section 11 .....	25
24.	Cross section 12 .....	26
25.	Cross section 13 .....	27
26.	Cross section 14 .....	28
27.	Conservative volume calculation point data .....	30
28.	Conjectured volume point data and line .....	31
29.	Standing wall (conservative) TIN model .....	32
30.	Standing wall (non-conservative) TIN model .....	32
31.	Total wall TIN model .....	33
32.	Standing wall TIN models overlaid on total wall TIN model .....	34

# LIST OF TABLES

1.	Wall Volume Data .....	34
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## EXECUTIVE SUMMARY

In July 2007, the Submerged Resources Center (SRC) and Kaloko-Honokōhau National Historical Park (KAHO) staff documented the collapsing 'Ai'ōpio Fishtrap prior to a wall rehabilitation project. The park requested complete documentation of the current wall condition and a volume estimate of wall fall. Using Global Positioning System (GPS), photographic documentation, and hand mapping, the SRC and park staff documented the outer fishtrap wall in its entirety including the intact, damaged, and dismantled portions. The SRC created a scaled plan view of the current condition of the wall, a detailed plan view of the break in the wall, several profile

views of intact portions of the ocean-side of the wall, and 14 cross sections along the length of the wall. In addition, the SRC calculated wall volumes using 3D modeling and spatial analysis in a Geographic Information System (GIS) project, which has been provided to the park. The resulting volume calculations provide a minimum estimate of 271.1 m<sup>3</sup> (354.59 yd.<sup>3</sup>, 9,573.81 ft.<sup>3</sup>) and a maximum estimate of 3,564.07 m<sup>3</sup> (4,661.63 yd.<sup>3</sup>, 125,863.9 ft.<sup>3</sup>) for the amount of displaced wall material on the site. The SRC recommends that a finding of “no adverse effect” to historical and archaeological material be attached to the wall rehabilitation project.

## INTRODUCTION

At the request of Kaloko-Honokōhau National Historical Park (KAHO), Superintendent Geri Bell and Integrated Resource Manager Richard Boston, the National Park Service's (NPS) Submerged Resources Center (SRC) assisted park personnel with documentation of the 'Ai'ōpio Fishtrap in July 2006. The 'Ai'ōpio Fishtrap is a 1.7-acre pond, consisting of a stone and coral wall forming an artificial enclosure along a naturally curving shoreline. The fishtrap had a variety of uses well into recent history, and it remains as a material signature of native Hawaiians' interactions with the sea. Over time, the wall has slowly collapsed, and in the last several decades, was intentionally dismantled in several places. KAHO secured funding to initiate rehabilitation of the

fishtrap seawall through the NPS's Project Management and Information System (PMIS). Park staff required that the site be archeologically documented before submitting rehabilitation plans to the State Historic Preservation Office for review. In response to Superintendent Bell's request, SRC researchers and KAHO staff completed a comprehensive site map and conducted photographic documentation of the 'Ai'ōpio Fishtrap to accompany a technical report describing the current condition of the fishtrap.

'Ai'ōpio Fishtrap is located in the southwest corner of the Honokōhau area of KAHO, three miles north of Kailua-Kona on the island of Hawaii (Figure 1).

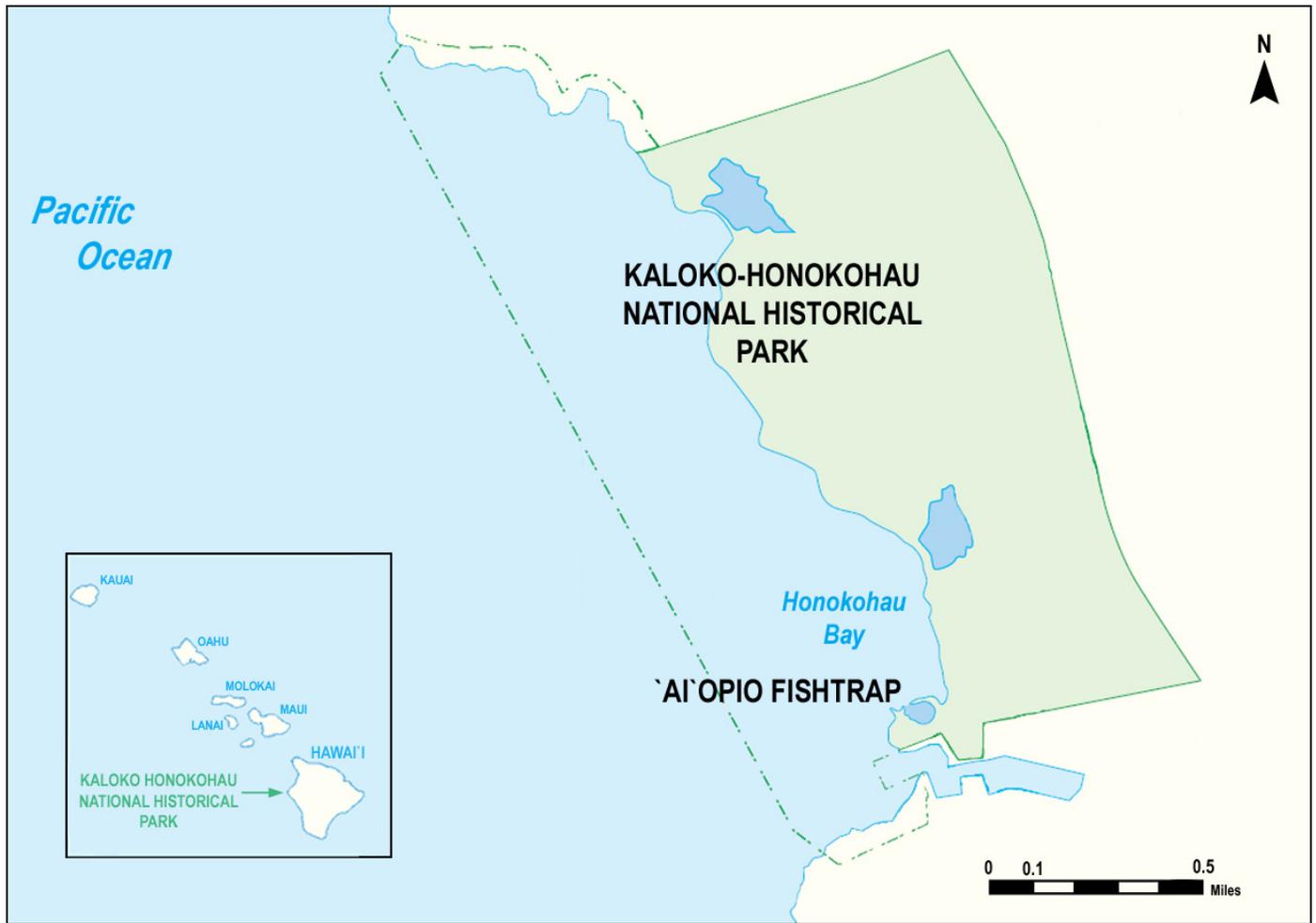


Figure 1. General Location of Kaloko-Honokōhau National Historical Park and the 'Ai'ōpio Fishtrap within the park.

The fishtrap is approximately 30 m (100 ft.) north of the park boundary along the southeast shoreline of Honokōhau Bay. 'Ai'ōpio is referred to as a fishtrap, rather than fishpond, because there is no *makaha* or sluice gate, and the trap contains four rectangular walled enclosures that may have been

used as holding pens for netted fish (Figure 2; see also Kikuchi and Belshe 1971: B9). 'Ai'ōpio is a *loko kuapa*-type fishtrap, meaning the builders created a wall as an artificial means for trapping fish as opposed to using natural shoreline features or an inland pond (Apple and Kikuchi 1975:8).

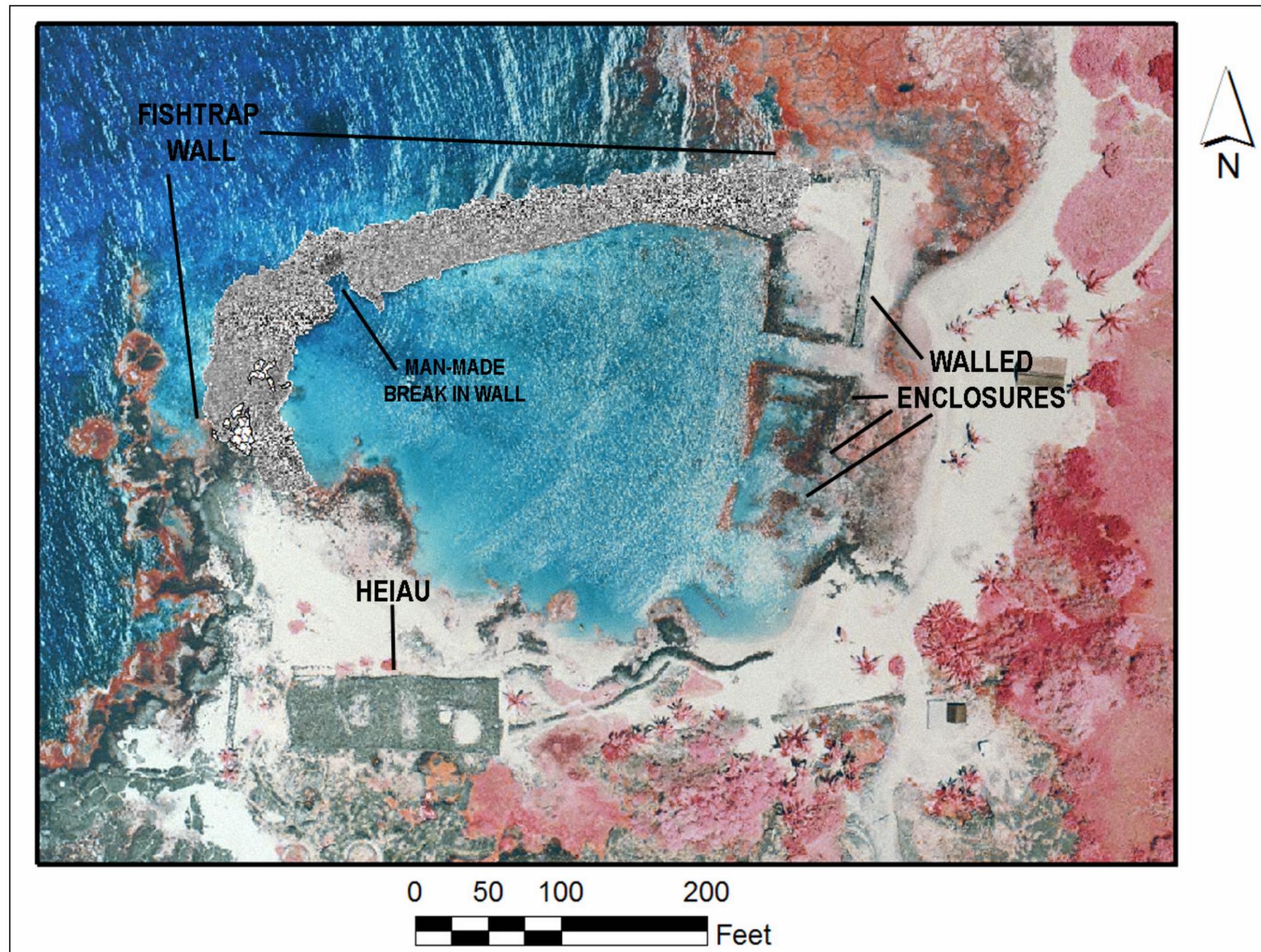


Figure 2. Aerial view of the 'Ai'opio Fishtrap including the walled enclosures and the associated *heiau* south of the fishtrap, with the site map of the outer fishtrap wall overlaid on the aerial image. Note the noticeable break through the center of the fishtrap wall.

The current condition of the 'Ai'ōpio Fishtrap is the product of both natural and human site-formation processes. Wave action and seasonal weather have damaged sections of the wall over time, while in the second half of the twentieth

century, occupants of the Honokōhau Bay shoreline dismantled a section of the outer seawall to create a break allowing canoe access to the ocean from the beach (personal communication, park staff).

## PROJECT GOALS

The primary project goal was to document the current condition of the 'Ai'ōpio Fishtrap prior to planned rehabilitation and reconstruction. Documentation methods included detailed Global Positioning System (GPS)-positioned hand-mapping and photographic documentation of the outer seawall and associated rubble scatter. In addition to this technical report, the primary documentation products include a plan-view archaeological drawing of the outer fishtrap wall (using standard Hawaiian conventions for showing

standing and fallen stacked stone walls), detailed profile drawings of portions of the outer seawall, a detailed plan-view map of the break in the outer seawall showing the original foundation stones, and a photographic database linked to the project Geographic Information System (GIS) incorporating a complete photographic record of seawall profiles. In addition, the documentation data were analyzed to estimate the total volume of displaced wall rubble for reconstruction planning purposes.

## METHODOLOGY

The SRC team, which arrived at KAHO on July 1, 2006, consisted of Archeologists Matthew A. Russell (Project Director), James E. Bradford, and Sami K. Seeb, Photographer Brett T. Seymour, and NPS GPS Program Coordinator Tim Smith. The SRC team met with KAHO Integrated Resource Manager Richard Boston and Archeologist Rick Gmirkin to discuss project goals and methodology before proceeding to the site to view the 'Ai'ōpio Fishtrap and associated cultural material. In addition to the outer fishtrap wall, which is the focus of this documentation, there are associated archaeological features that include several walled enclosures within the fishtrap, scattered *emu* throughout the pond, and the *heiau*, and anchialine ponds south of the fishtrap. SRC and KAHO personnel surveyed construction techniques of the fishtrap wall and *heiau* to determine the most efficient and effective site documentation methodology.

After a preliminary site survey, the SRC and KAHO team developed a site-specific methodology for site documentation. The plan-view

archaeological map of the 'Ai'ōpio Fishtrap was created on a foundation of high-resolution GPS points collected with a Trimble Navigation, Ltd.'s (Sunnyvale, California) R8 Global Navigation Satellite System (GNSS). The Trimble R8 GNSS consists of a pair of multi-channel, multi-frequency receivers, antennas, and a data-link radio capable of survey-grade resolution that is typically sub-centimeter. The Trimble R8 can collect survey points comparable in accuracy to traditional archaeological survey methods using a total station, but points can be collected much more quickly and efficiently. The Trimble R8 GPS system includes a wireless base station, set up daily on an established survey point near the park welcome center (Figure 3), and a field receiver, which was mounted on a range pole and used for on site positioning. The base station monitored its reported position from various satellites in the GPS constellation—when satellites gave inaccurate locations for the base station, the base station generated a corrected position for those satellites and broadcast the corrected, differential signal to the field receiver via

a radio operating at 450 mHz. For site mapping, a high-resolution GPS point was taken every few feet along the intact sections of the fishtrap wall, as well as along the outer edge of the fallen-rock scatter. The field receiver, attached to the range pole, was placed on the desired location for point capture, and the range pole was leveled using an attached bubble level. A Trimble TSC2 data collector with integrated Bluetooth technology provided a wireless interface for data collection and storage from the receivers.

Once the network of GPS points defining the outline of the fishtrap wall and its various features was collected, the plan-view site map was hand-drawn around the skeleton of points using photographs and observations by archaeologists on site. The GPS was also used to collect elevation data for 14 cross-sections across the fishtrap wall and a series of topographic points around the top of

the wall for volume calculations. Detailed hand-mapping was used to document two outer wall profiles and the position of foundation stones on the seabed in the outer-wall break. Finally, the site was documented using a Nikon D100 digital still camera with a 16-mm lens and a Sony HVR-Z1U high-definition digital video camera. Select digital still images were integrated into the project GIS database using GPS Photolink software (Geospatial Experts, Thorton, Colorado). The software uses a time-correction calculation to match the photograph capture time to a GPS-point capture time, which links the point location to the associated photograph. After linking the photographic file to the associated GPS point, the photograph was hotlinked to its corresponding point in ESRI's (Redlands, California) ArcGIS 9.1, enabling users to scroll over points and view corresponding photographs.

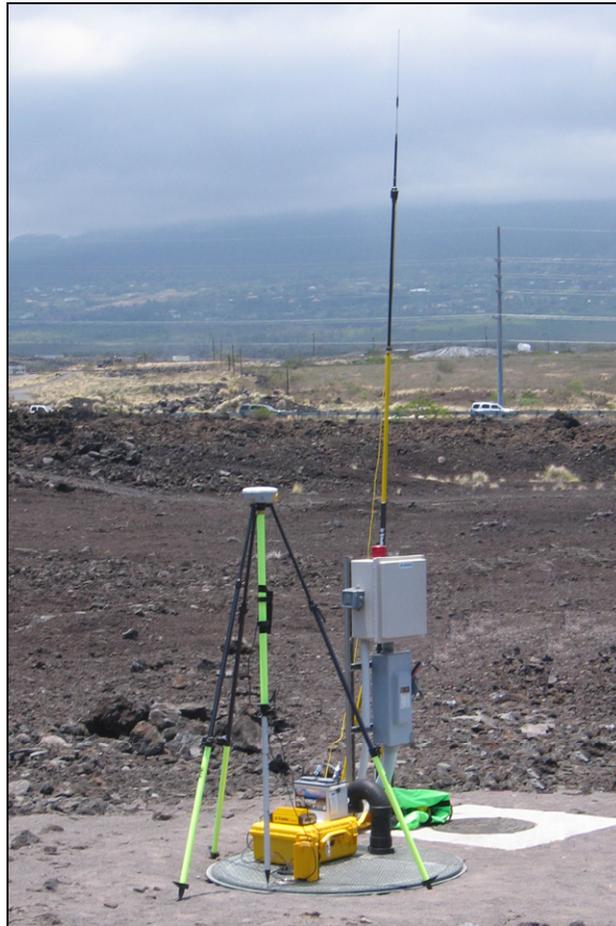


Figure 3. The GPS base station near the KAHO welcome center. NPS Photo by Sami Seeb.

## GPS AND PHOTOLINK DOCUMENTATION

Site documentation began with intact sections of the exterior (ocean-side) fishtrap seawall. The SRC and KAHO team began documentation at a stone marking the western edge of a previous stabilization project on an eastern section of the fishtrap wall. The GPS data collector required a 3 to 5-m (10 to 16-ft.) proximity to the GPS receiver. This was achieved by one person walking atop the wall or by kayaking in deeper water to capture points while another person carried the GPS receiver on the range pole and placed it on the point location (Figure 4). At the same time, an underwater photograph of the point and adjacent wall section was taken and above-water photographs were taken of intact wall sections above the waterline. Additional team members

recorded point numbers, descriptions, and image numbers corresponding to each point. Point locations followed the outline of *in situ* base stones along intact sections of the exterior fishtrap wall (Figure 5), and then moved to the interior (pond-side) of the fishtrap to record an intact section. The only intact interior portion was a short segment previously stabilized by park staff, much smaller than intact ocean-side portions. Once documentation of all intact wall sections was complete, GPS documentation concentrated on both exterior and interior rubble and wall collapse to document the scatter extent. In this way, a continuous outline of both intact and scattered sections of the fishtrap wall, exterior and interior, was completed.

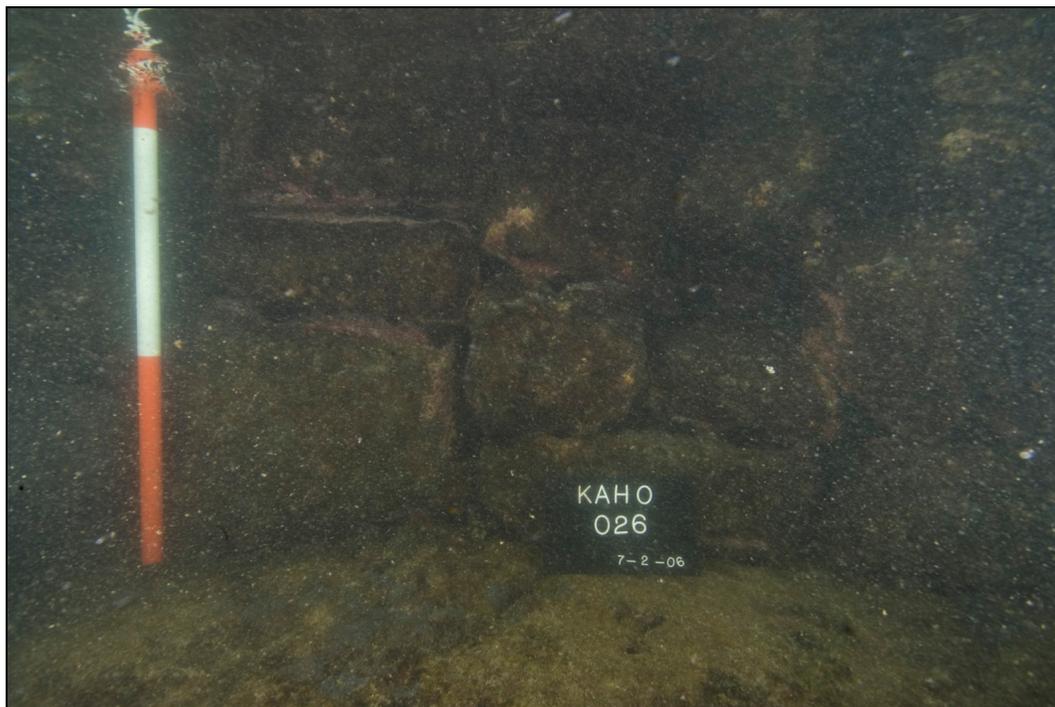


Figure 4. Capturing GPS Point 026 on the ocean-side of the fishtrap seawall. NPS Photo by Brett Seymour.



Figure 5. GPS documentation of intact sections of the ocean-side fishtrap seawall. NPS Photo by Matt Russell.

After collecting a complete network of GPS points outlining exterior and interior intact wall sections and perimeter rubble scatter, the SRC/KAHO team collected GPS points along perpendicular transects across the fishtrap wall, from interior (pond-side) seabed to exterior (ocean-side) seabed, to document wall cross-sections. A cross-section transect was collected approximately every 10 m (labeled T1 through T14). Along each transect, points were collected approximately every 0.5 m to 1 m.

After completing the 14 cross-section transects, random GPS points were collected along the top of the wall to establish wall topography and to calculate wall volume. The team also used the GPS to document rock alignments possibly associated with fishtrap wall construction episodes near the wall's western terminus. Park contractors working with KAHO staff to rebuild walls at 'Ai'ōpio Fishtrap and Kaloko Fishpond marked these alignments with pin flags and GPS points were collected every few feet along the alignments.

The park requested positions on several features for planning purposes, including each corner of the *heiau* to assist with aerial photograph rectification, at two different wells near the park visitor center, from a survey point near the north boundary of the park, from an aerial photo target, and on the south end of the Kaloko Fishpond wall.

The team recorded a total of 1,051 positions in KAHO (incorporated into the GIS project). The GPS-generated point metadata exhibit a high degree of positional accuracy. The highest horizontal accuracy observed from the points measured 0.3 cm (.19 in.); the lowest horizontal precision measured 33.6 cm (13.22 in.), which gave an average horizontal point accuracy from the 1,051 points of 1.0 cm (0.39 in. circle-of-error probable [CEP]). The highest vertical accuracy measured 0.9 cm (0.35 in.); the lowest observed vertical accuracy was 86.2 cm (33.97 in.), which gave an average vertical accuracy of 2.1 cm (0.83 in. CEP).

## SITE MAPPING

Archeologists documented sections of the 'Ai'ōpio Fishtrap wall in detail through scaled hand-mapping of features. Base stone detail in the fishtrap wall break required direct measurements for accurate documentation. The mapping team stretched a baseline along the center of the break in an east-west orientation, and flagged the corners of each base stone. Using baseline trilateration, archaeologists mapped each of the foundation stones relative to the baseline. Each feature was also extensively documented in a series of

photographs to aid in reconstructing the base stone layout on a map (Figure 6). Direct measurement with photographic documentation also included two profiles of intact, ocean-side wall. These profiles were mapped by setting a level baseline along the length of each section and taking vertical measurements off the baseline to each rock making-up that section of wall (Figure 7). Finally, the team collected data for a plan view of a large marking stone near the eastern wall terminus.

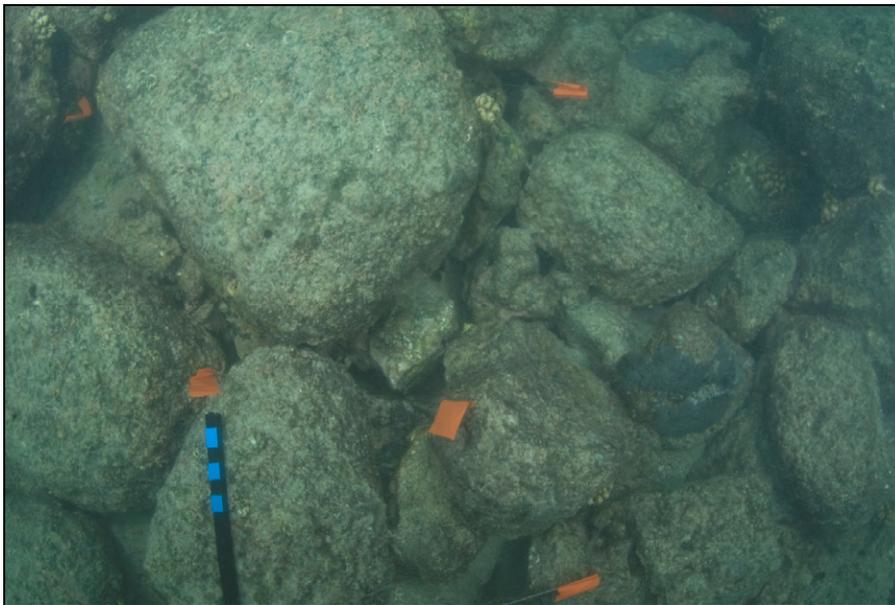


Figure 6. Pinflagged seawall foundation stones in the wall break during documentation. (1-foot Photographic scale) NPS Photo by Brett Seymour.



Figure 7. Hand-mapping an intact wall section on the ocean-side of the outer fishtrap seawall to create a profile drawing. NPS Photo by Brett Seymour.

## RESULTS

### MAPS AND DRAWINGS

Fieldwork by the SRC/KAHO team resulted in a comprehensive documentation of the 'Ai'ōpio Fishtrap outer seawall, including a detailed, plan-view site map (Figure 8). Using the high-resolution GPS points as a skeleton, photographs and written descriptions provided the information necessary to complete the plan view outline of the wall. Once completed, the wall outline was scanned and filled with stones using Adobe Photoshop software.

Individual stones incorporated within the wall were not documented on site; their locations have been estimated based on observations and photographs.

The overall site map was georectified using ArcGIS and added to the project GIS database. The detailed plan view of the seawall break and eastern marking stone were added to the final site map by georectifying and inserting the individual maps using ArcGIS.

GPS cross sections and direct-measured, hand-drawn profiles are georectified to allow them to be overlaid on the site map in ArcGIS for additional analysis (Figure 9).

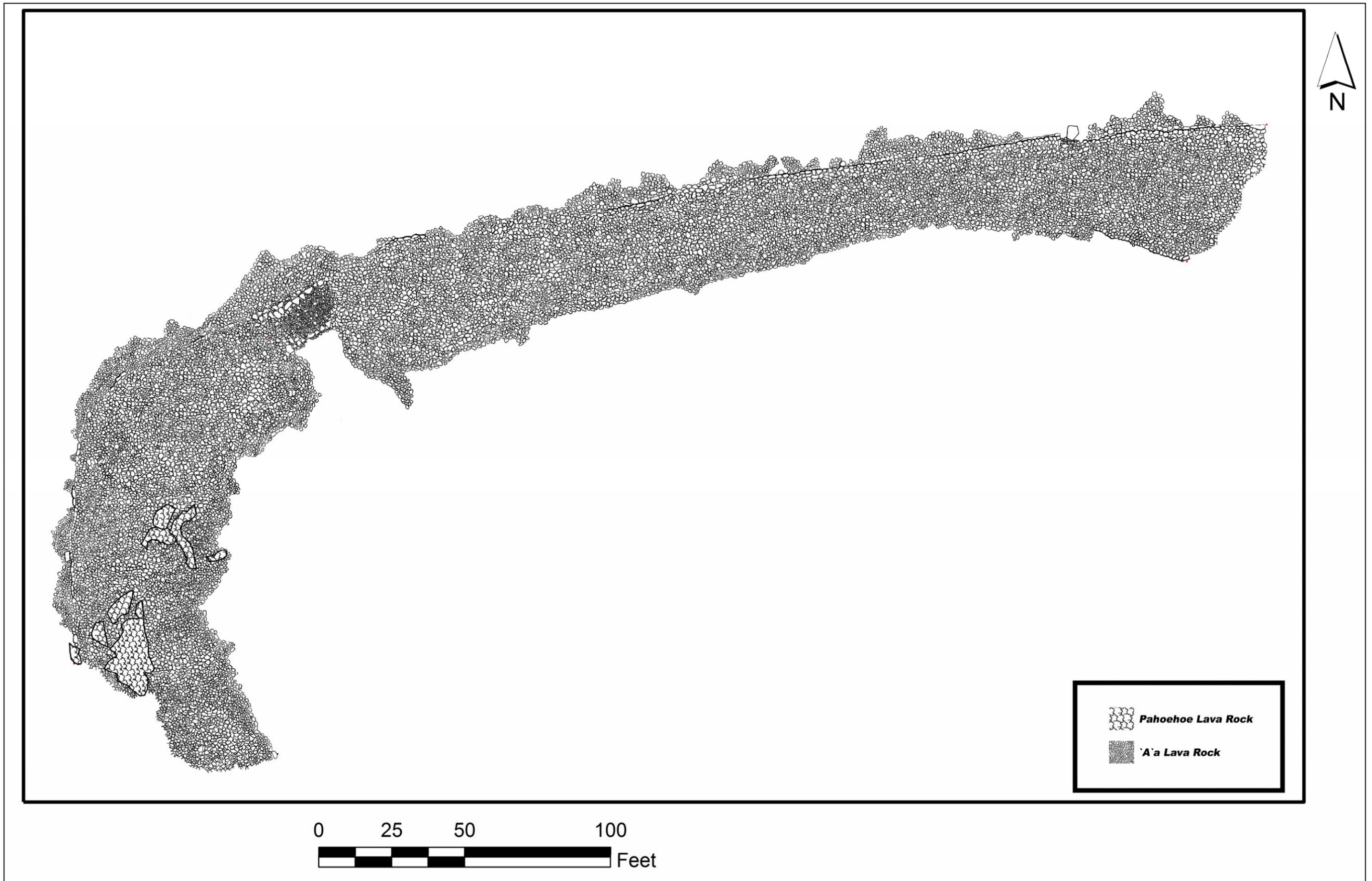


Figure 8. Planimetric map of the 'Ai'ōpio Fishtrap outer seawall. Drawing by Sami Seeb.

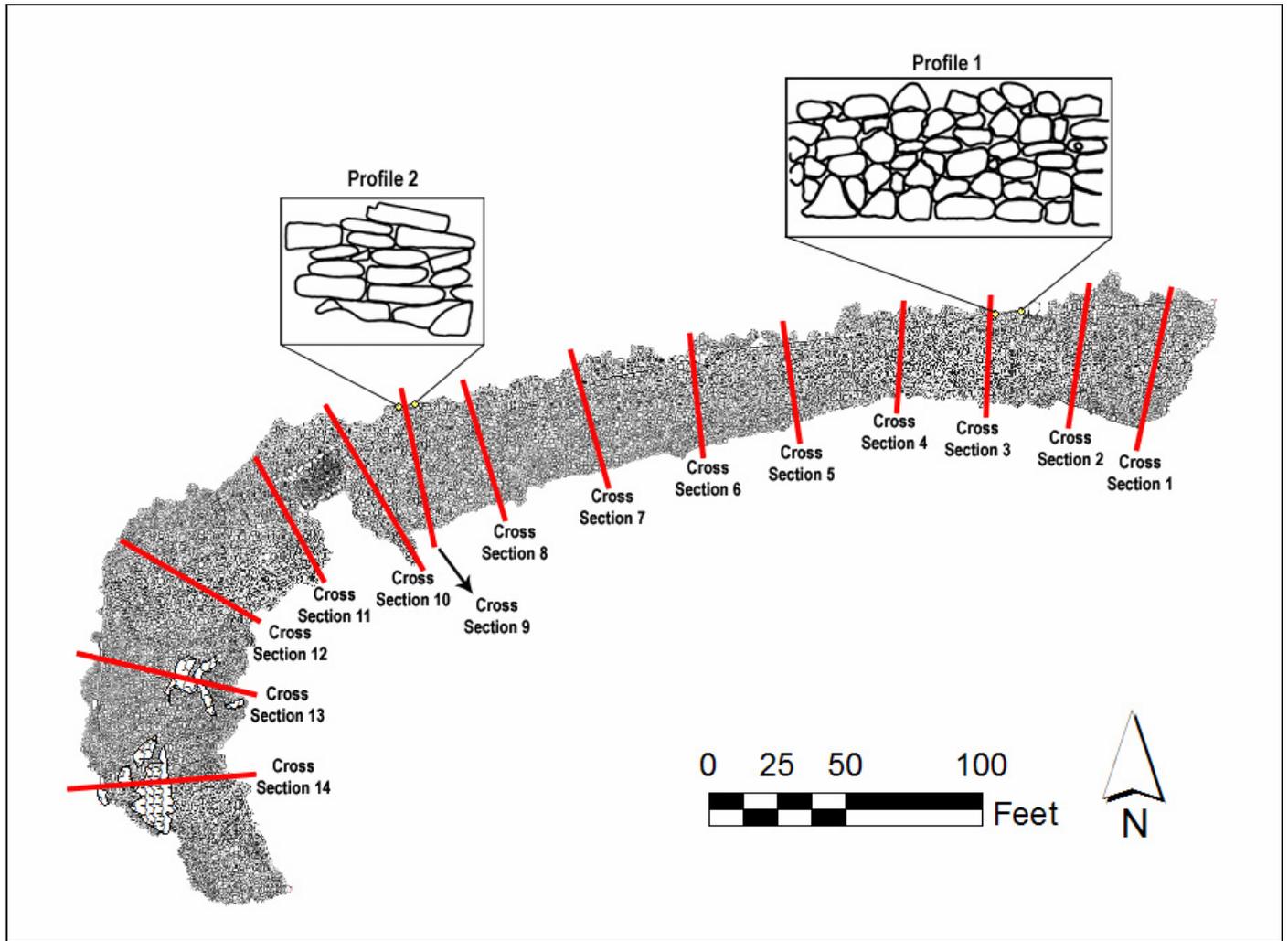


Figure 9. 'Ai'ōpio Fishtrap site map indicating locations of hand-mapped, intact wall profiles and GPS cross section positions. Map drawn by Sami Seeb.

Processing the first day's GPS data and incorporating them in the KAHŌ ArcGIS data base presented a minor problem. The park is located in UTM Zone 4, while the majority of the island of Hawaii is in UTM Zone 5. Previously, the park collected and processed data as if it was taken in Zone 5, rather than Zone 4, which is the correct UTM Zone for the data. In order to allow the

project's field data to be incorporated into the park's GIS data base, SRC collected and processed all data as if they were collected in Zone 5. Although this did not affect the GPS point collection, it can make data use problematic with some GPS receivers and can create confusion in the GIS data if this discrepancy is not noted in the park's GIS data base metadata.

Scale drawings of fishtrap wall sections provide construction details and offer insight into the progression of the wall construction through various construction episodes. The fishtrap wall break reveals large base stones that may have been the original wall foundation and that may indicate

the original wall dimensions. Smaller stones are fill between the base stones. The SRC/KAHO team used data acquired from baseline trilateration combined with photographic documentation to draw a detailed scaled drawing of the base stones and fill (Figure 10).

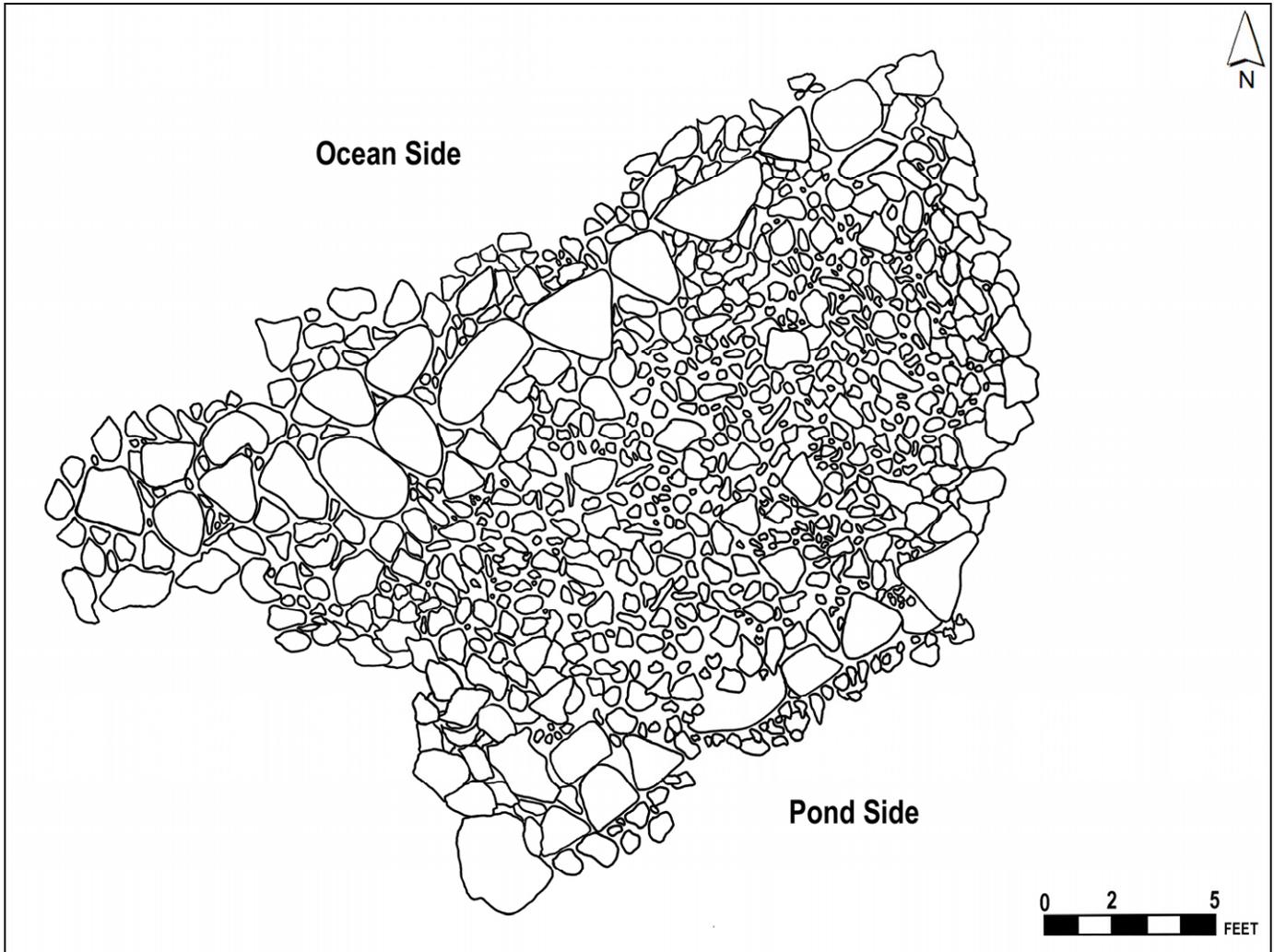


Figure 10. Detail of the outer fishtrap seawall break showing the large foundation stones that form the original interior and exterior wall faces. Drawing by Sami Seeb.

Two scaled profiles of intact sections of the ocean-side fishtrap wall demonstrate construction features of the original wall (Figures 11 and 12). These profiles provide representative examples for

the rehabilitation project to indicate the current conditions of intact wall sections. Also, the profiles will serve as guides for future reconstruction of displaced wall sections.

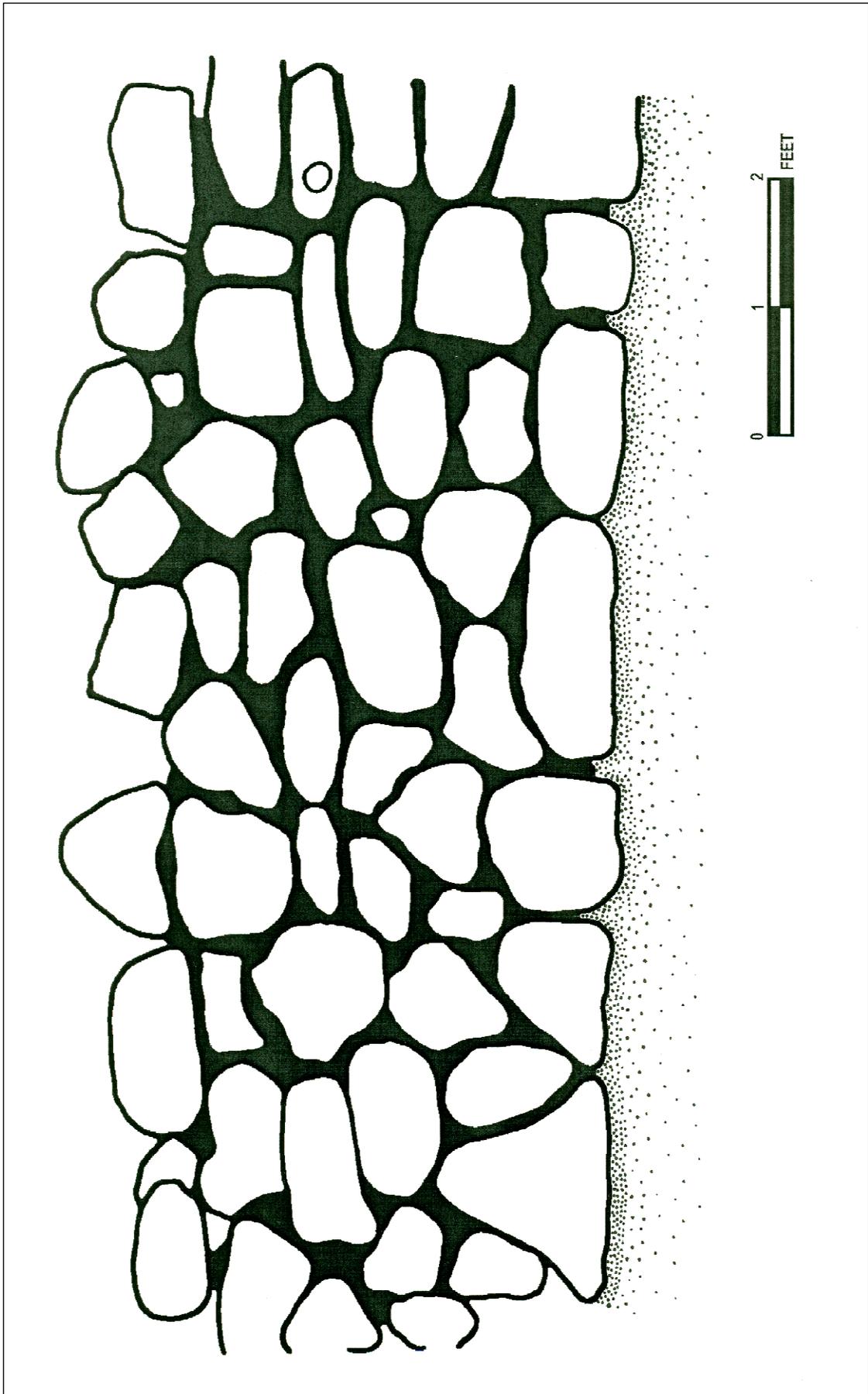


Figure 11. Profile 1, showing an intact section on the ocean-side of the fishtrap wall. Drawing by Matt Russell and Sami Seeb.

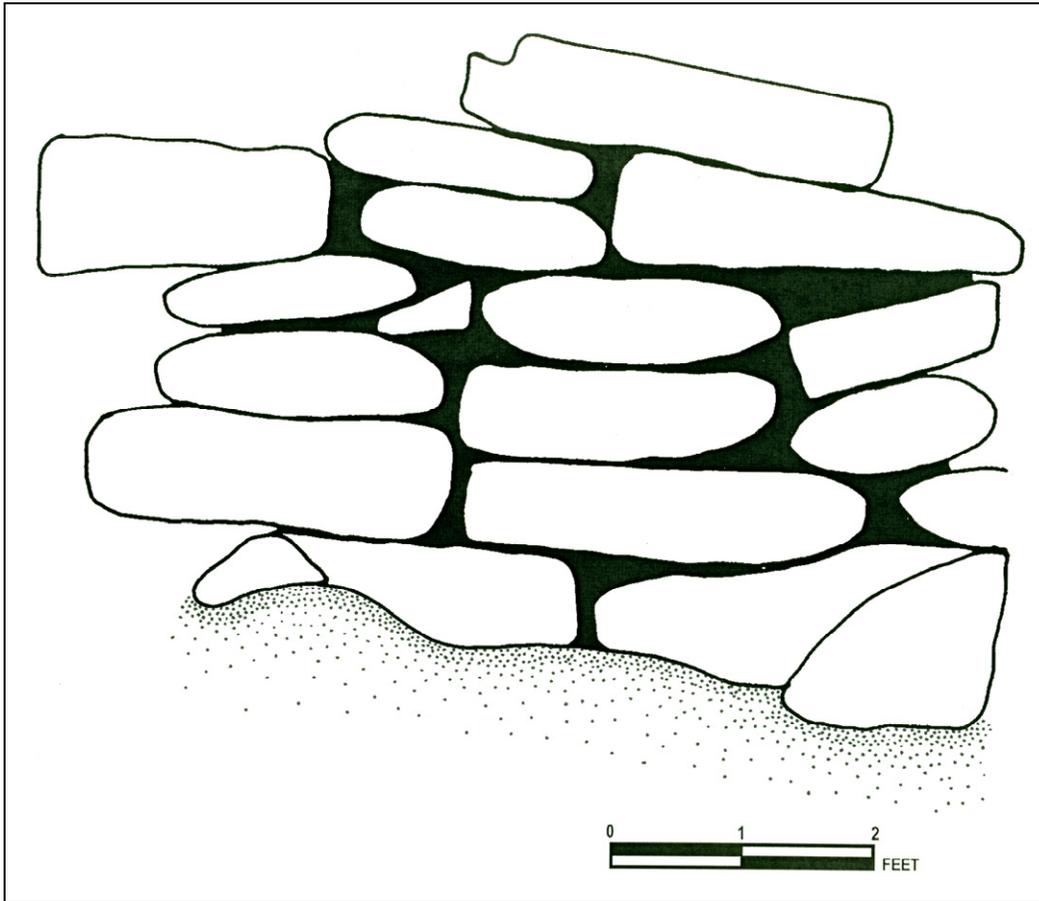


Figure 12. Profile 2, showing an intact section on the ocean-side of the fishtrap wall. Drawing by Matt Russell and Sami Seeb.

### CROSS SECTIONS

The SRC/KAHO team used the Trimble GPS unit to collect elevation points along 14 transects across the wall to create a series of wall cross sections (Figures 13-26). Examining cross sections individually shows the variation in wall height (relative to sea level datum) as well as the distance that fallen rubble extends beyond the original wall boundary. Looking at the cross sections together provides a relative indication of the varying state of integrity along the wall's length.

While the cross sections themselves are accurately calculated and depicted in Figures 13-26 from the project GIS using high resolution GPS data, the designations within the cross sections are based on assumptions made while taking GPS points in the field. Without prior knowledge of the exact width of the original wall, it was difficult to say with certainty in some sections what remained of the standing wall and what was wall fall or rubble—Figures 13-26 show classifications of

standing wall, wall rubble, and sand or base within each cross section based on direct field observations. The zero value on the y-axis represents sea level at that location based on the 1988 North American Vertical Datum. The yellow sections in each figure indicate standing wall, the orange areas denote wall rubble, and the green sections represent the sand or base. The blue dots represent individual GPS points taken across the wall.

The two cross sections containing no color fill (Cross Sections 10 and 11, Figures 22 and 23) border the break in the wall on either side—because it is likely that those who made the break removed the rocks from the wall and relocated them adjacent to the break on both sides and to the north, resulting in a large amount of displaced rock adjacent to these two cross sections, it was impossible to discriminate between standing wall and scattered rubble.

**Aiopio Fishtrap- Cross Section 1**  
**Kaloko-Honokohau National Historical Park**

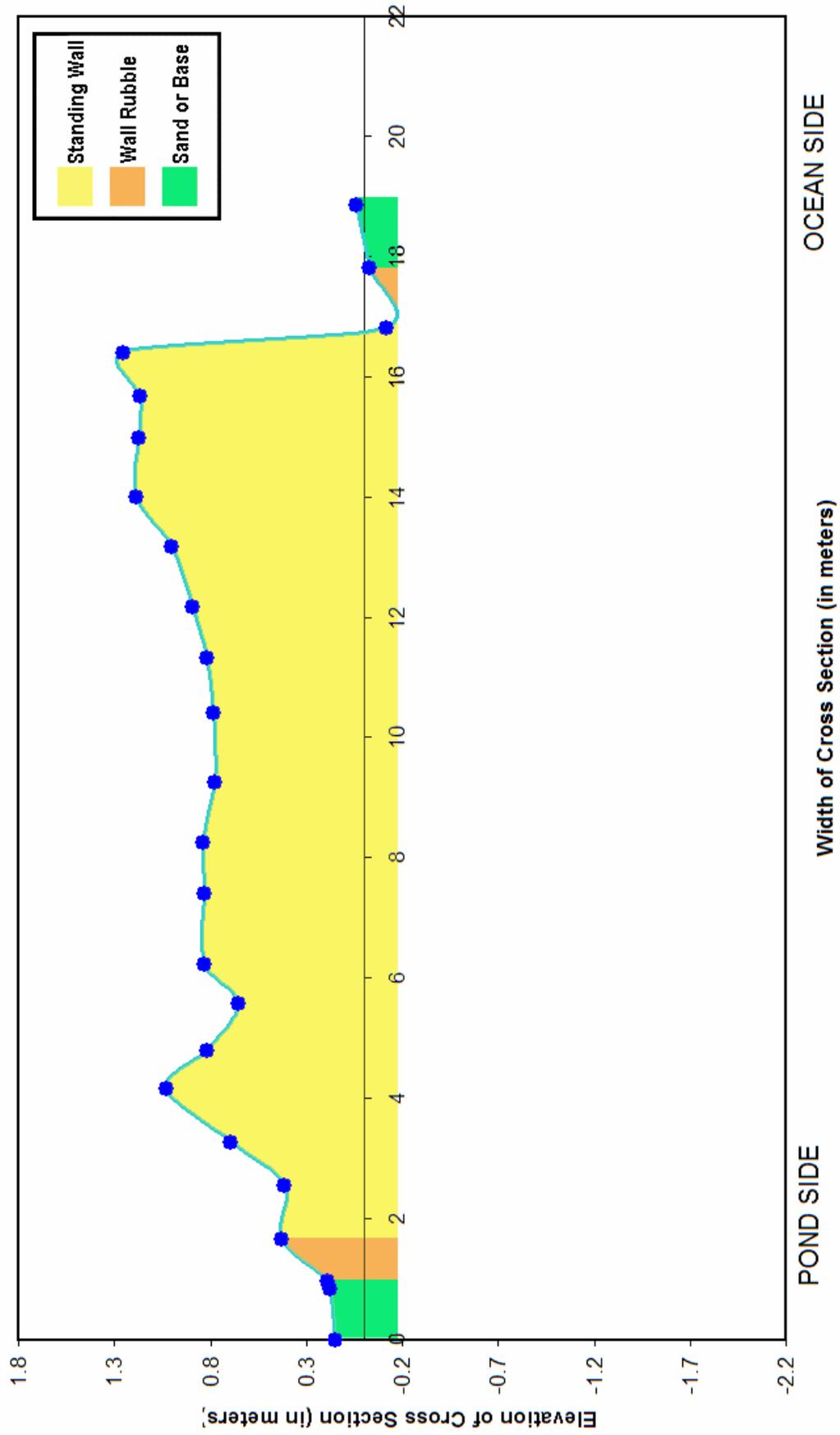


Figure 13. Cross section 1.

**Aiopia Fishtrap- Cross Section 2**  
**Kaloko-Honokohau National Historical Park**

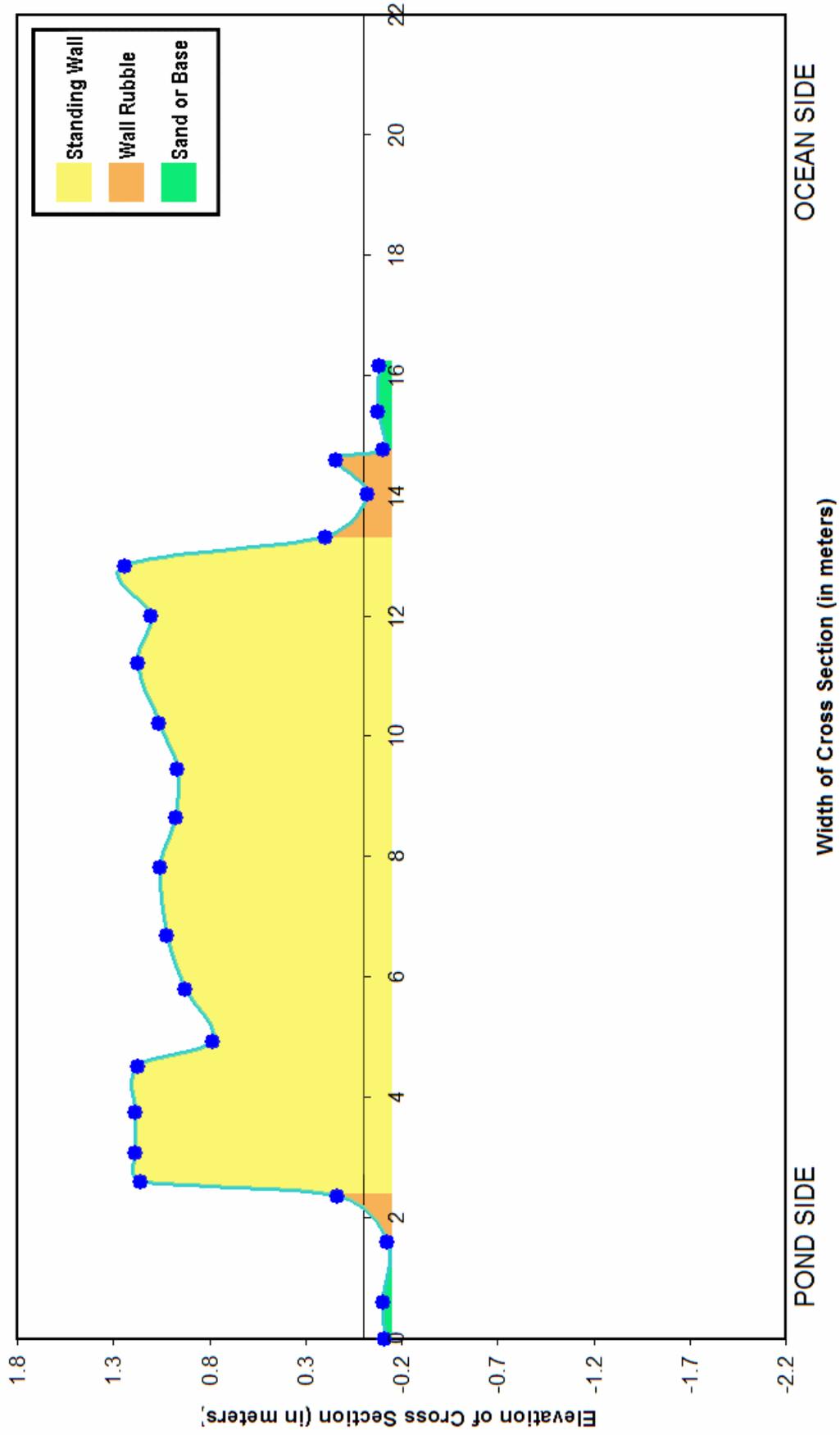


Figure 14. Cross section 2.

**Aiopio Fishtrap- Cross Section 3  
Kaloko-Honokohau National Historical Park**

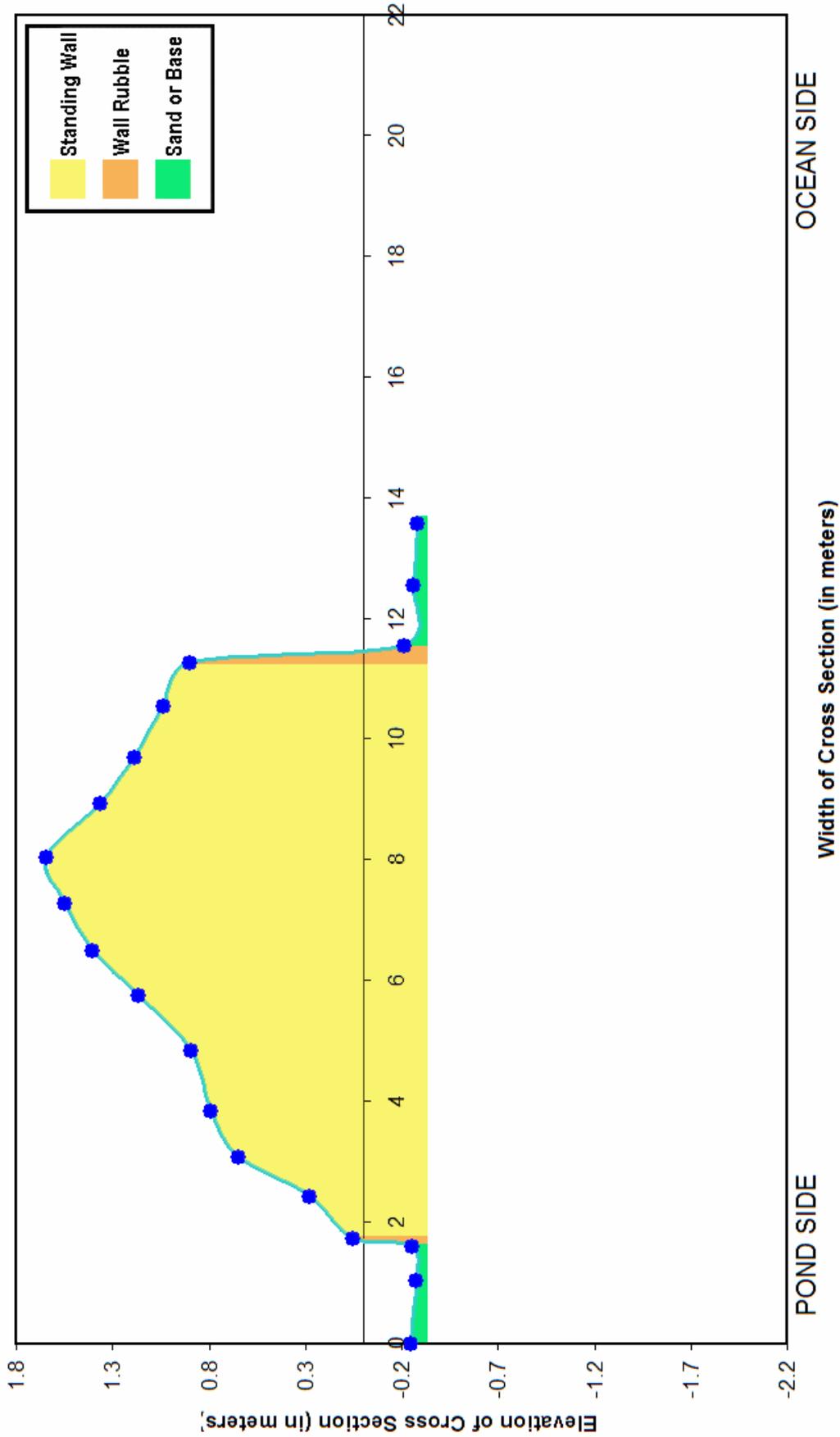


Figure 15. Cross section 3.

**Aiopio Fishtrap- Cross Section 4  
Kaloko-Honokohau National Historical Park**

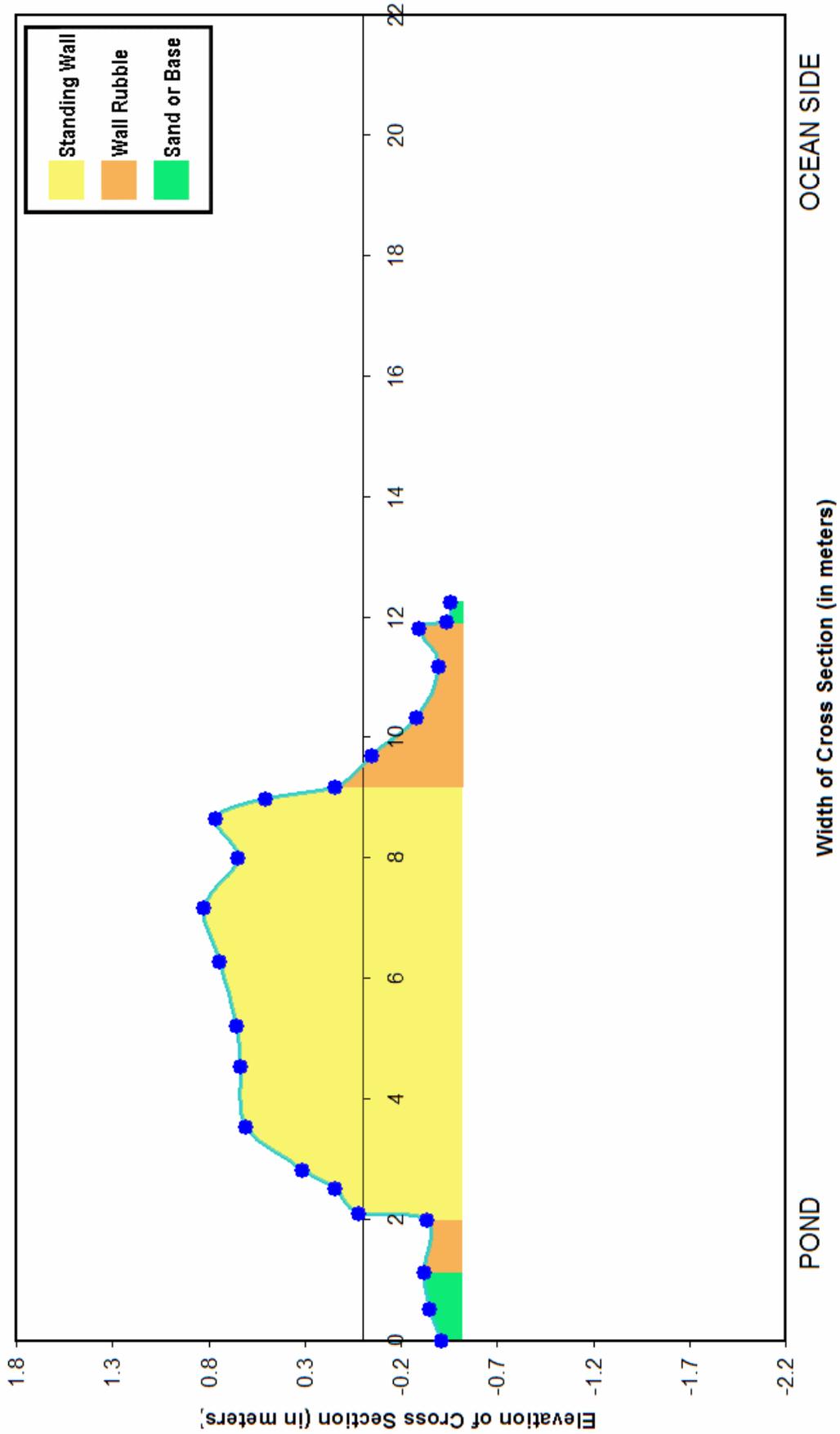


Figure 16. Cross section 4.

**Aiopio Fishtrap- Cross Section 5  
Kaloko-Honokohau National Historical Park**

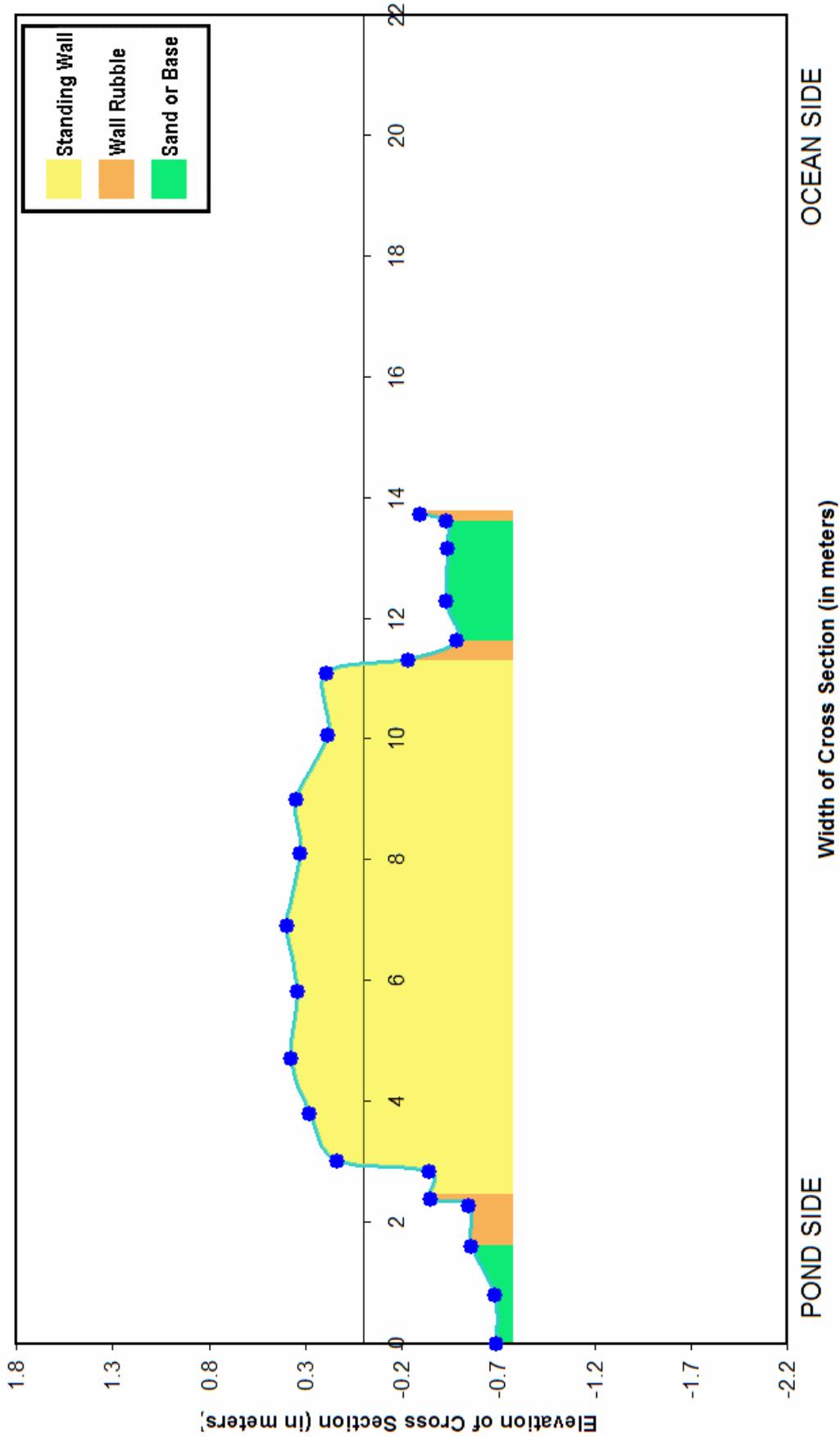


Figure 17. Cross section 5.

**Aiopio Fishtrap- Cross Section 6  
Kaloko-Honokohau National Historical Park**

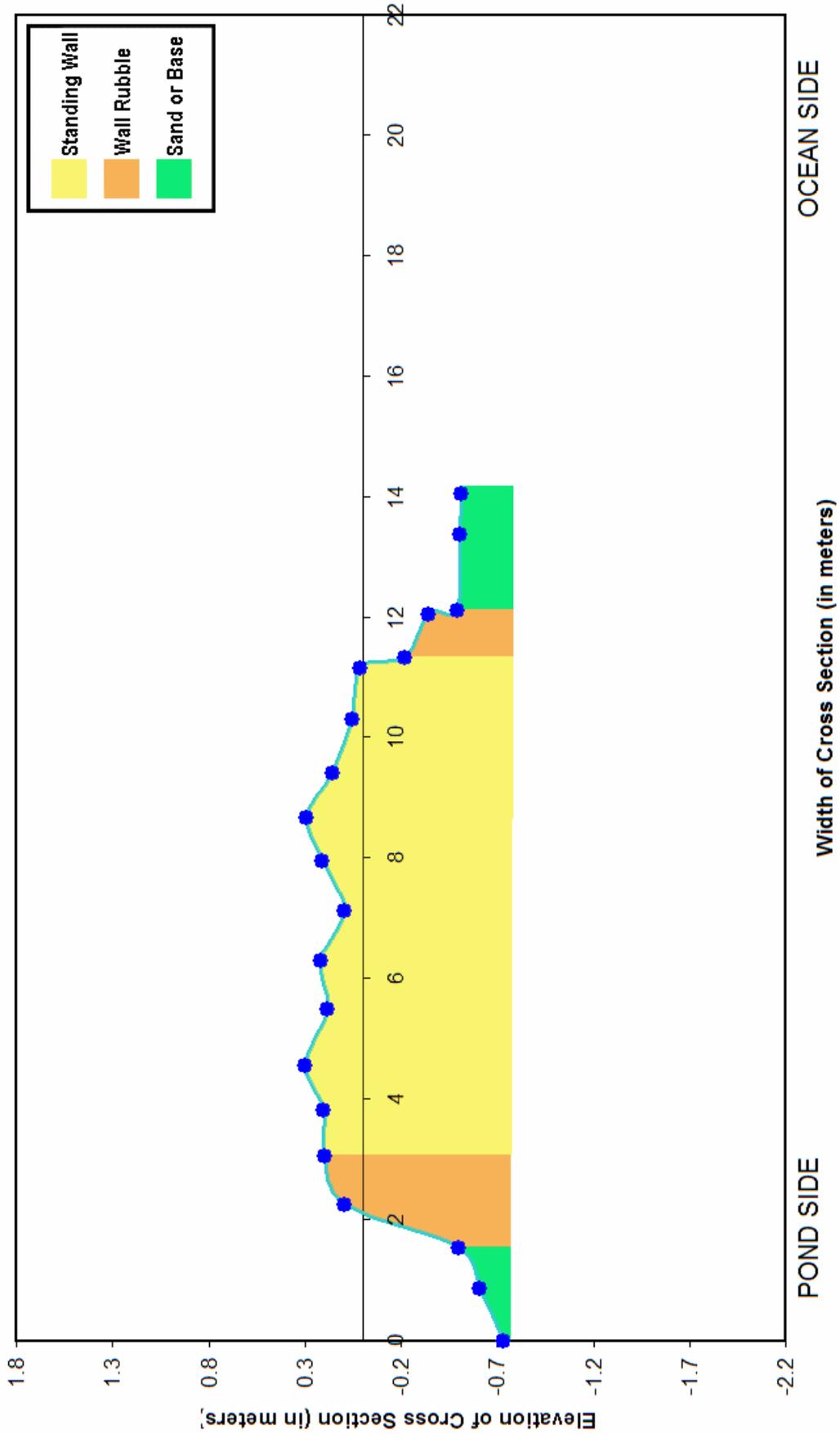


Figure 18. Cross section 6.

**Aiopio Fishtrap- Cross Section 7**  
**Kaloko-Honokohau National Historical Park**

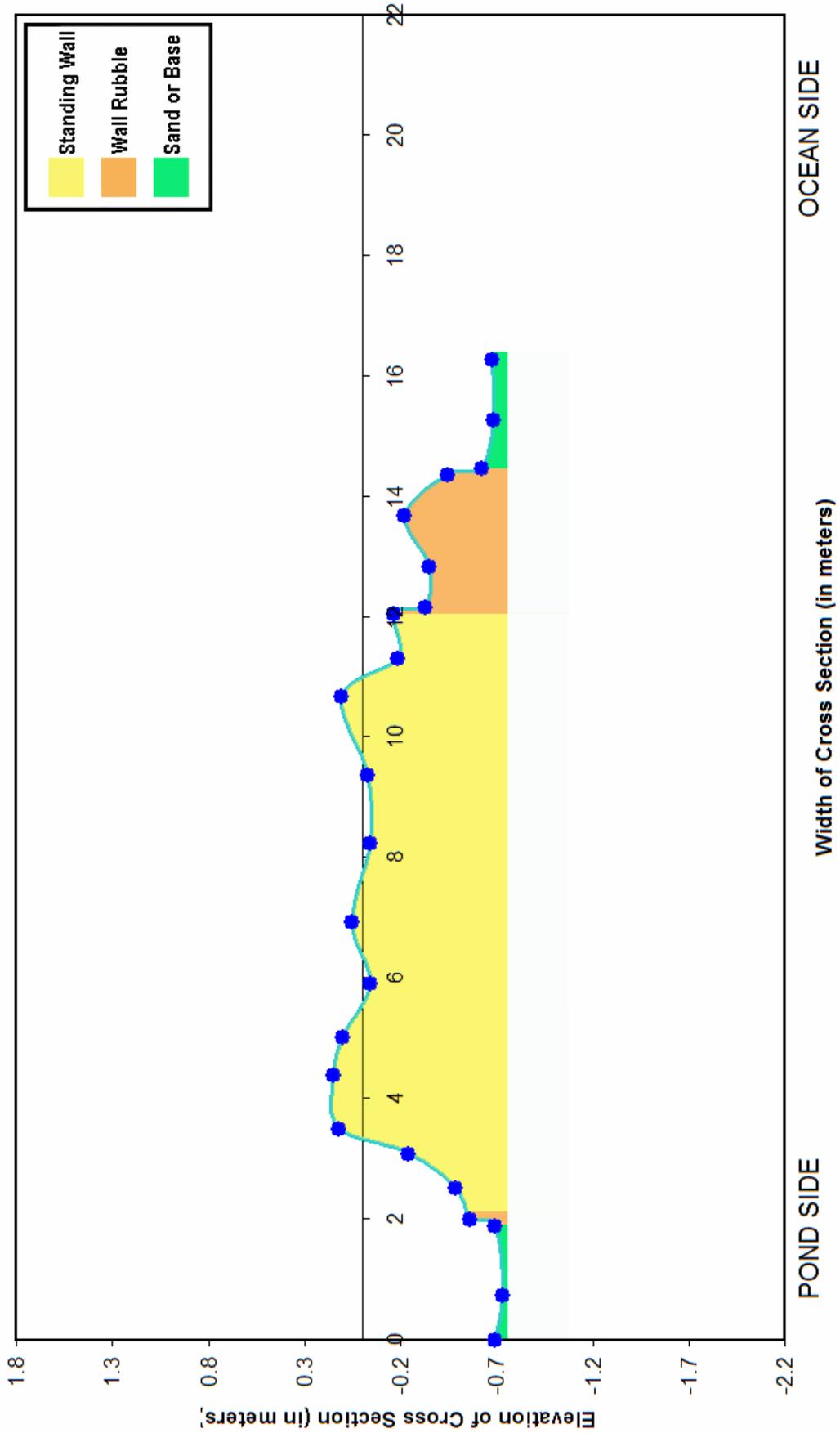


Figure 19. Cross section 7.

**Aiopio Fishtrap- Cross Section 8**  
**Kaloko-Honokohau National Historical Park**

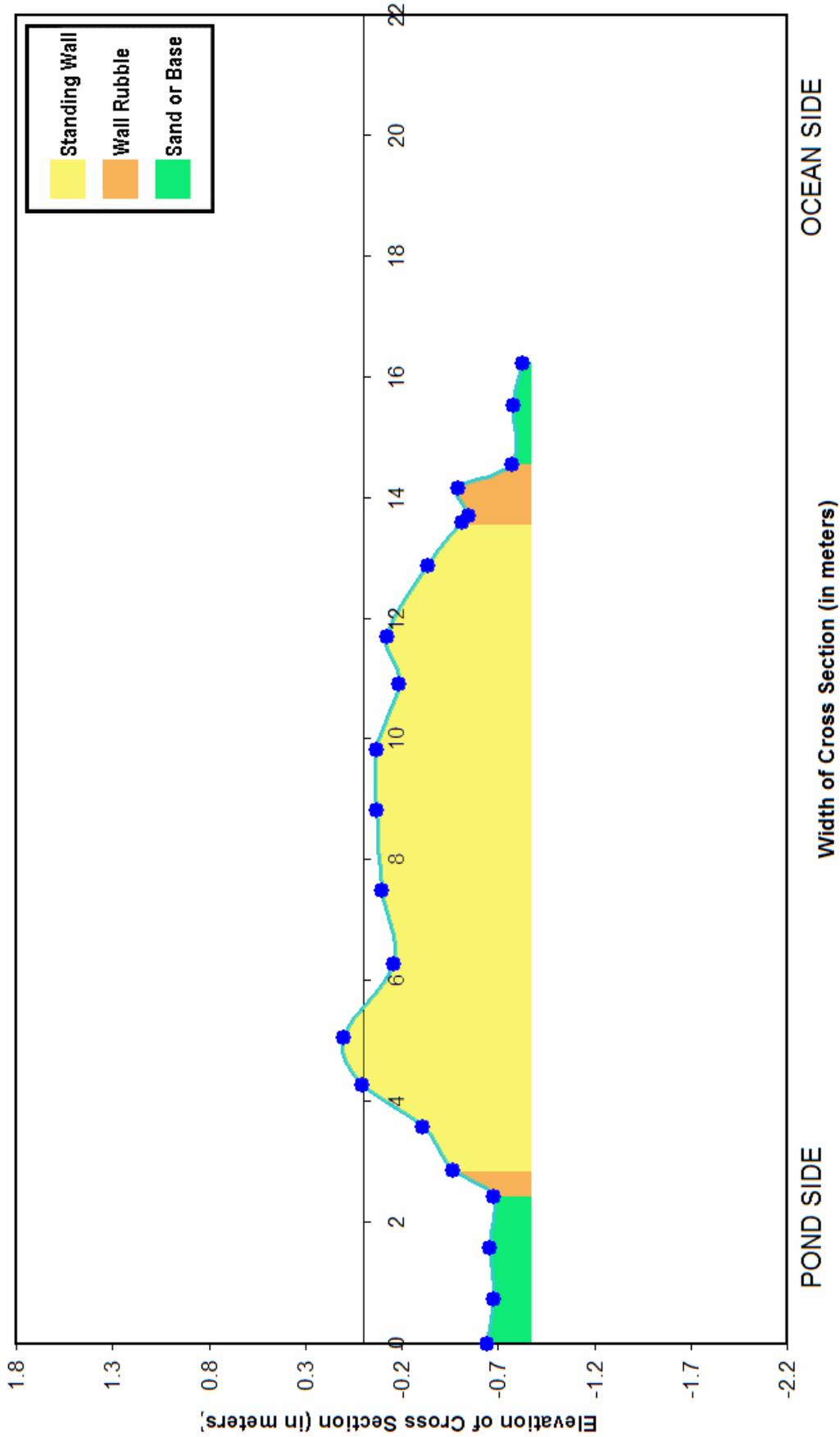


Figure 20. Cross section 8.

**Aiopio Fishtrap- Cross Section 9  
Kaloko-Honokohau National Historical Park**

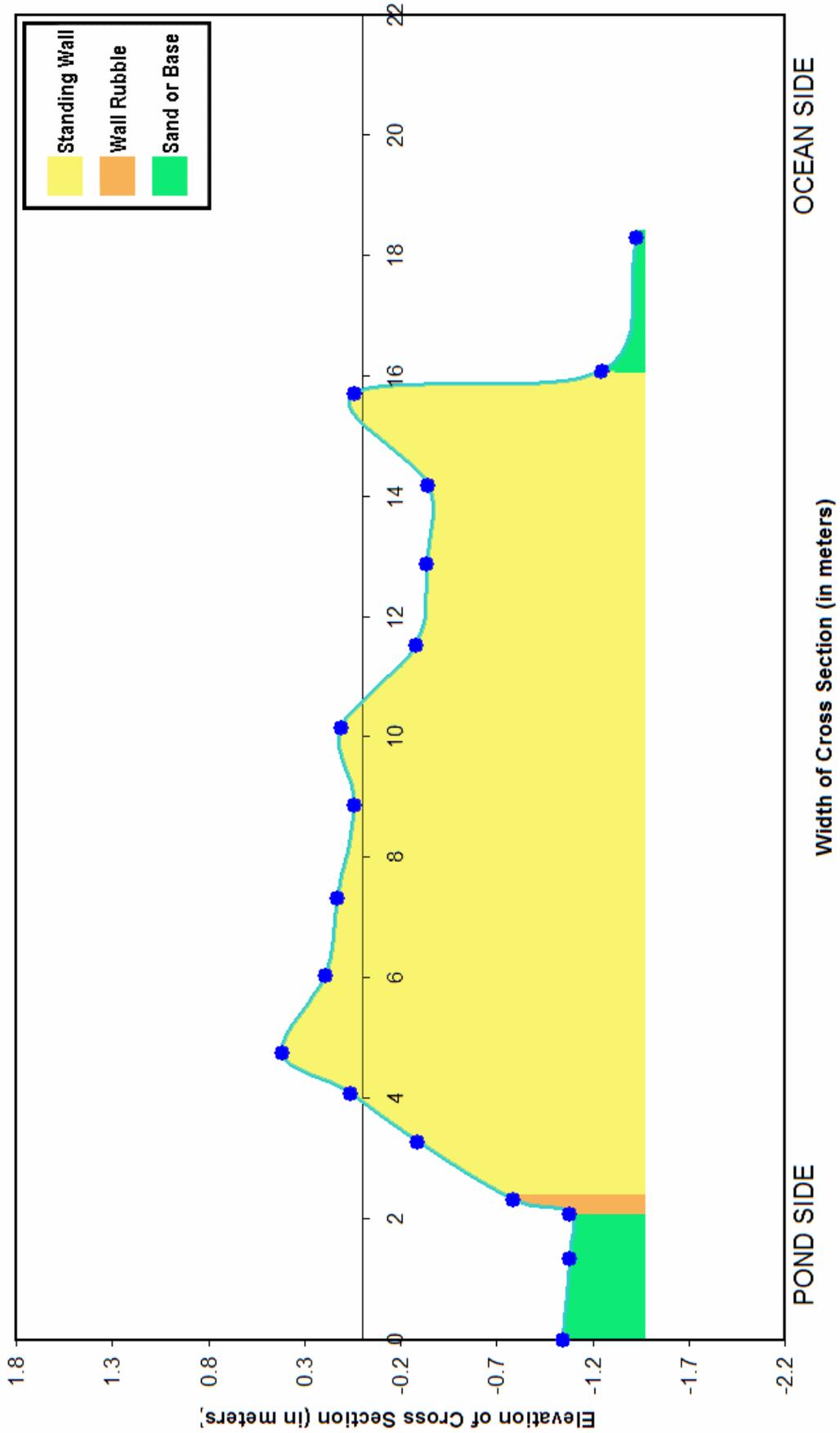


Figure 21. Cross section 9.

**Aiopia Fishtrap- Cross Section 10**  
**Kaloko-Honokohau National Historical Park**

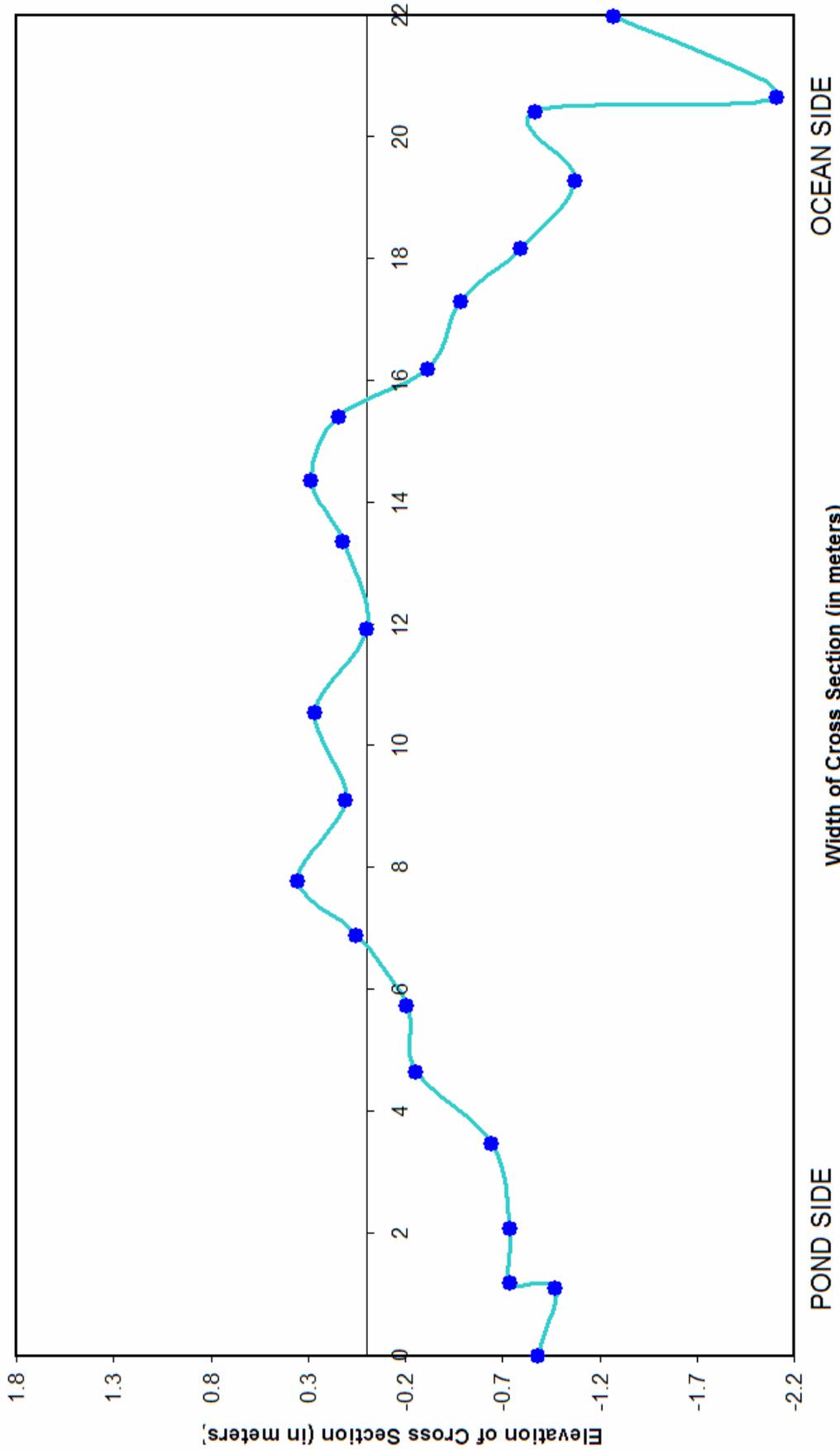


Figure 22. Cross section 10.

**Aiopia Fishtrap- Cross Section 11**  
**Kaloko-Honokohau National Historical Park**

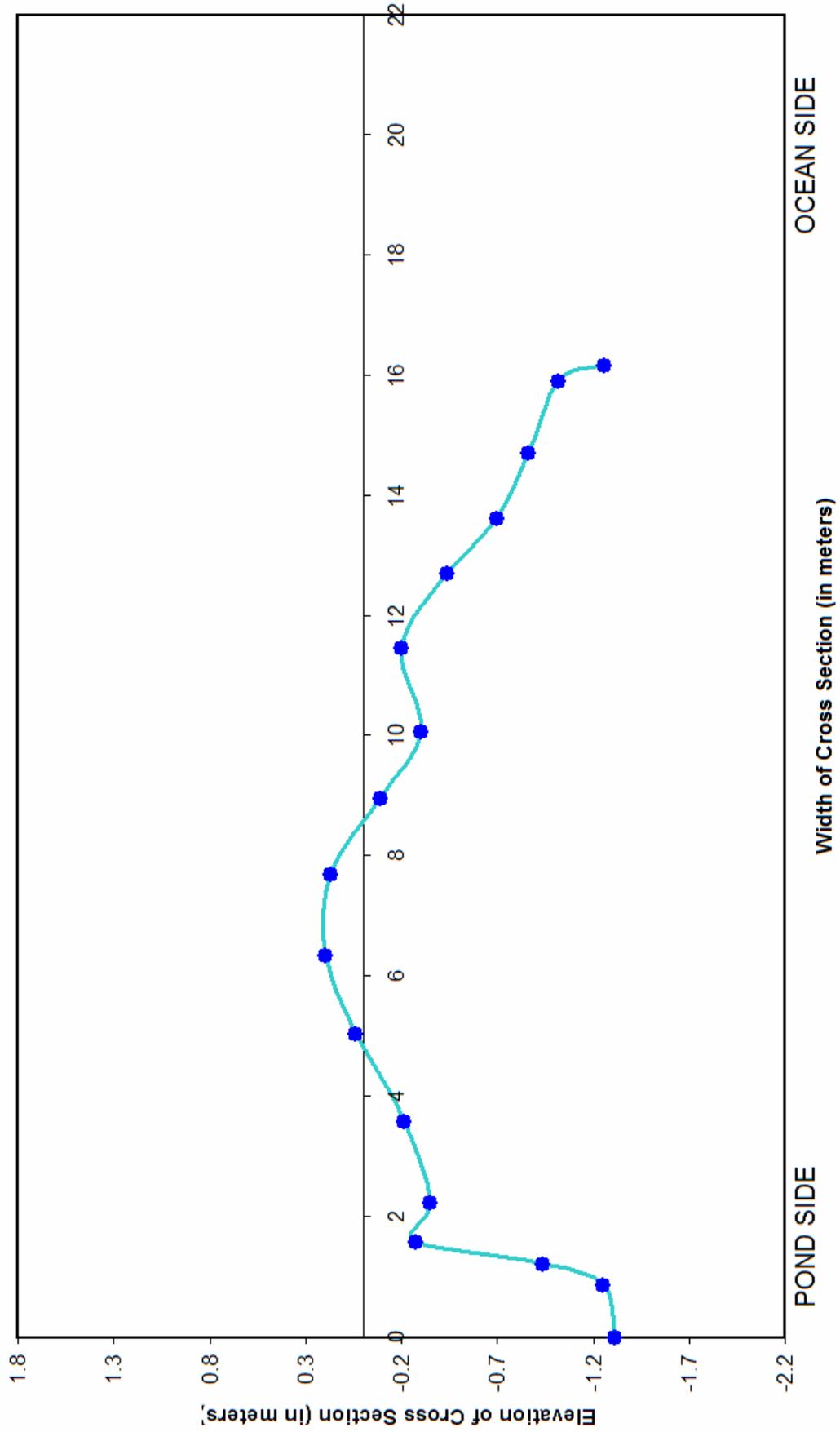


Figure 23. Cross section 11.

**Aiopio Fishtrap- Cross Section 12**  
**Kaloko-Honokohau National Historical Park**

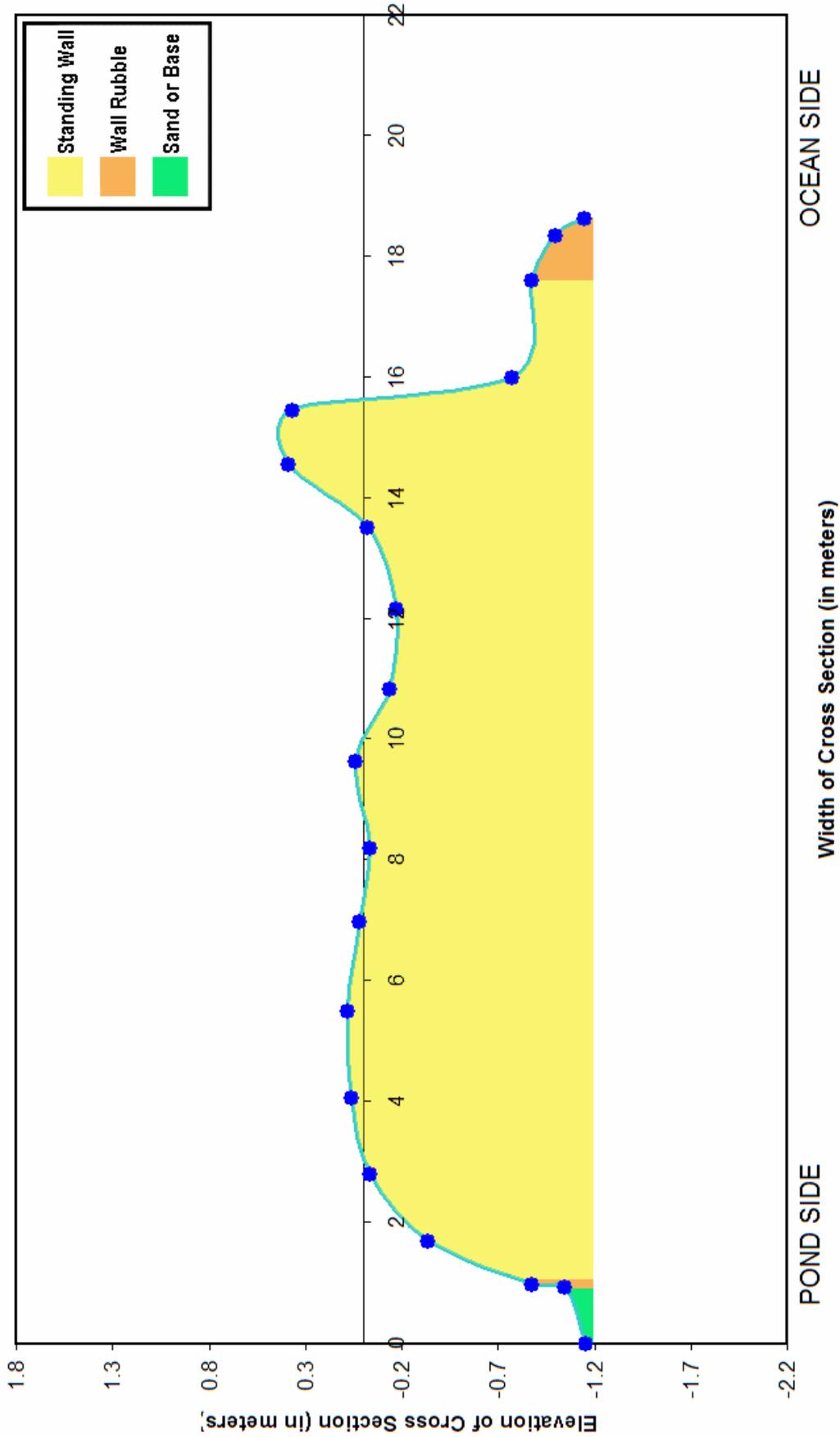


Figure 24. Cross section 12.

**Aiopia Fishtrap- Cross Section 13**  
**Kaloko-Honokohau National Historical Park**

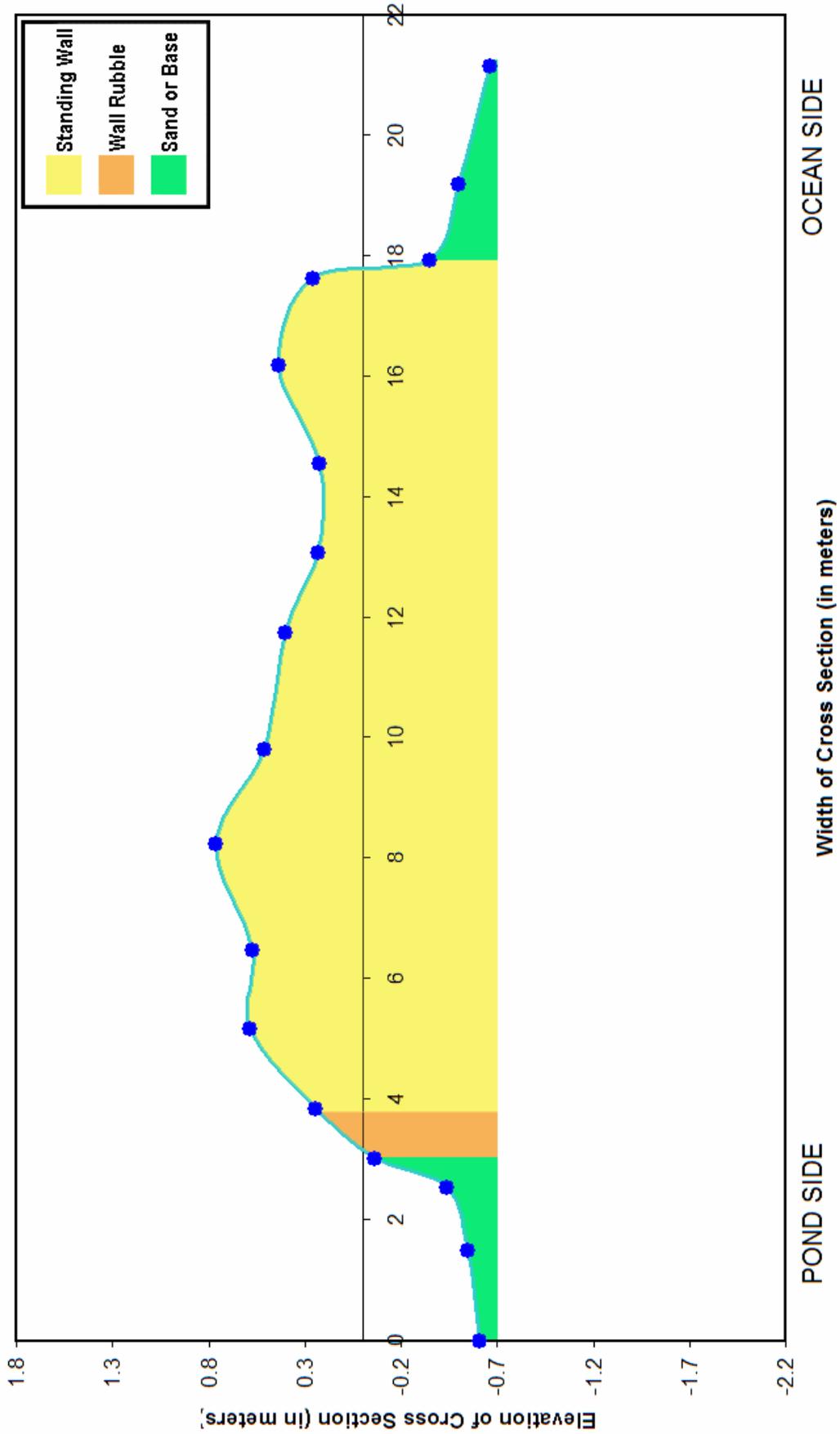


Figure 25. Cross section 13.

**Aiopio Fishtrap- Cross Section 14**  
**Kaloko-Honokohau National Historical Park**

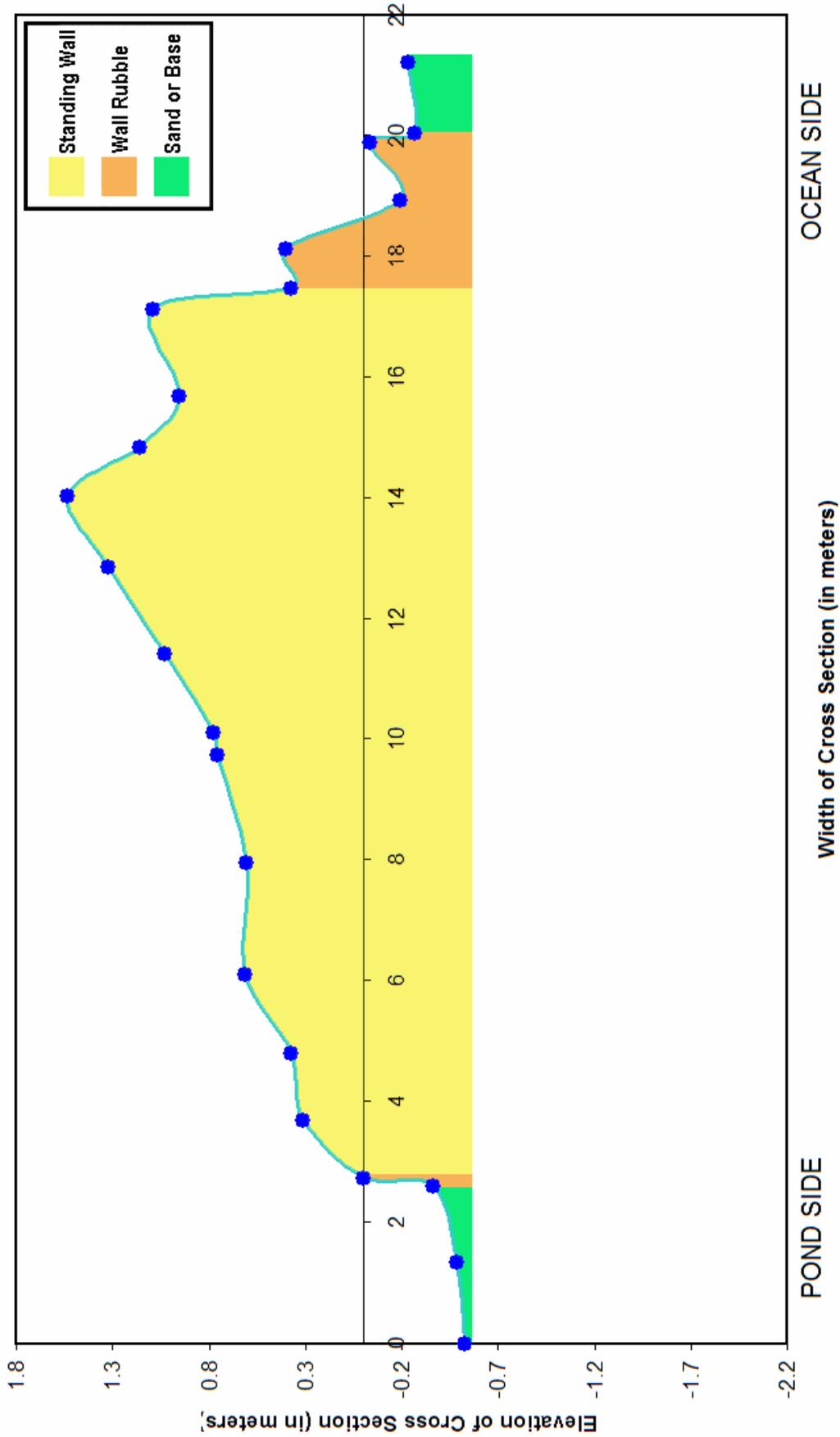


Figure 26. Cross section 14.

## VOLUMETRICS

To gauge the degree of reconstruction necessary to rehabilitate the wall, KAHO personnel requested an estimate of the volume of rock rubble that has fallen from the intact wall and is now scattered on both the exterior and interior of the wall. Based on the data collected, SRC archeologists determined that the most accurate means of generating the volume of wall fall would be to create two sets of volume calculations. The first is a conservative calculation of the rock rubble based solely on GIS point data and field descriptions. The second is a more conjectural (but probably more accurate for management purposes) calculation based on wall dimensions extrapolated from the collected GIS-based data. To complete the volume estimate, we devised a series of restrictive assumptions while processing GIS and positional data to calculate volumes. First, we assumed that no wall material had been removed from the site, only relocated on the site itself. Second, because the actual location of the original exterior and interior wall faces and original wall width are

unknown in much of the wall, for the conservative calculation, we used only the GPS data retrieved in the field (shown in Figures 13-26) as opposed to extrapolation described below. These data included positional information and point descriptions assigning designations of standing wall, wall fall, or base to each point. Third, we used previously reconstructed sections, base stones, and noticeable alignments in the western terminus to extrapolate a line representing the estimated interior wall face in order to calculate the less conservative volume of wall fall.

To calculate the volume of displaced material, we isolated the material in the standing wall from the total material recorded, which included the scattered rubble on both the wall's exterior and interior. The total wall points collected included all standing wall points and associated wall rubble. Point descriptions were used to isolate the points within the standing wall for the conservative estimate (Figure 27).

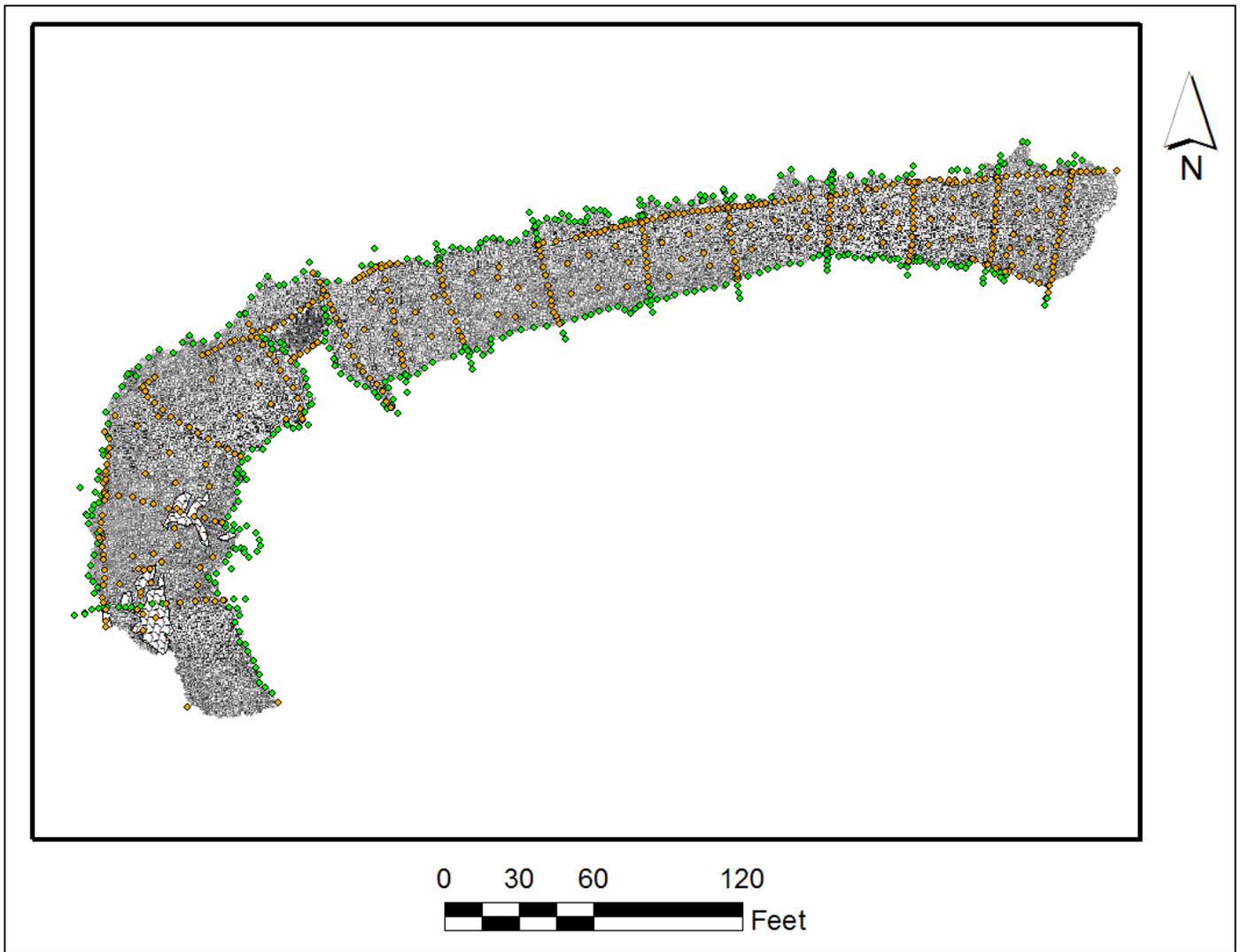


Figure 27. Isolated points used to calculate the more conservative volume. The orange symbols show points located on standing or intact wall sections. The green symbols show other points delineating the entire wall.

For the less conservative estimate, archaeologists extrapolated the pond side face of the wall based on a number of indicators in the archaeological remains. First, the previously reconstructed portion of the eastern terminus was used to delineate the standing wall at that location. Next, the base stones in the cut section provided sufficient evidence to suggest the original width of

the wall at that location; a line was drawn from the intact section on the eastern terminus along the pond side base stones in the cut section. Finally, this extrapolated line connected on the western terminus based on a series of rock alignments that indicated the possible original wall face in that location (Figure 28).

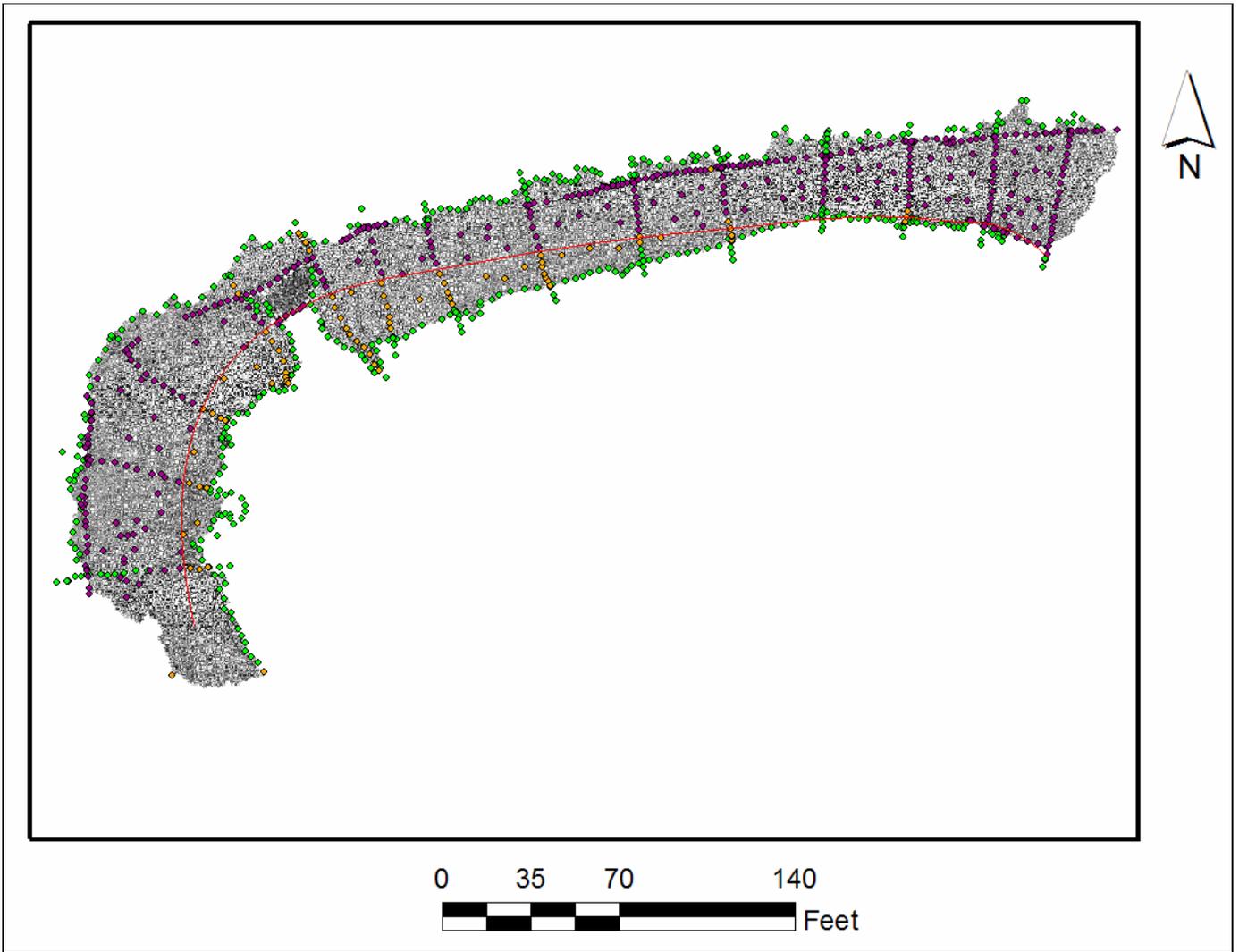


Figure 28. Line and points used to calculate the less conservative volume of wall fall. The red line represents the extrapolated pond-side wall face. The purple symbols represent the standing wall points based on the extrapolated wall face. The orange symbols are points that were considered standing in the conservative calculation, but are considered rubble in the less conservative calculation. The green symbols, again, show other points delineating the entire wall including rubble.

After creating three sets of data from the isolated points (total points, conservative standing wall, non-conservative standing wall), a three dimensional Triangulated Irregular Network (TIN) model was resolved from each data set. A TIN model consists of vector data organized in geographic space with contiguous, non-overlapping triangles that together create a three-dimensional

structure of the input data. The 3D model depicted in Figure 29 represents the portions of the standing wall based on the conservative data, Figure 30 shows the TIN resolved from the non-conservative standing wall data, and Figure 31 shows the resolved TIN of the total wall including standing wall and associated rubble scatter.

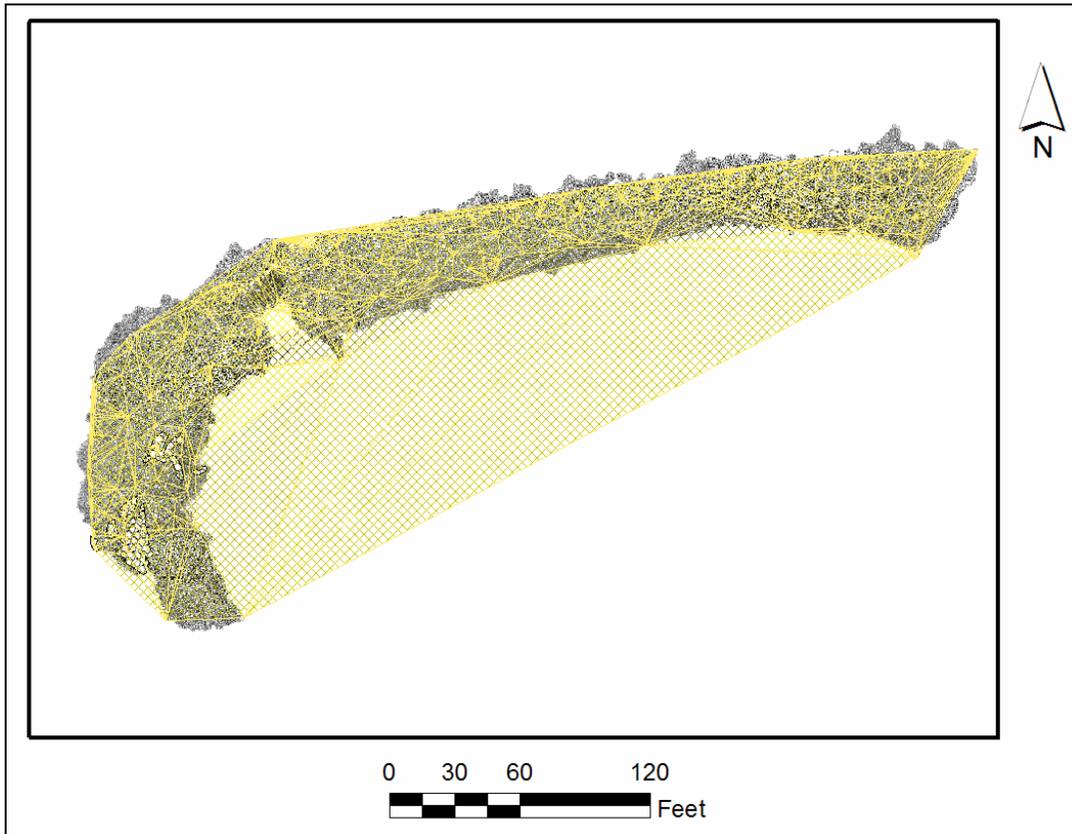


Figure 29. TIN model of the standing wall data (conservative) overlaid onto the planimetric site map.

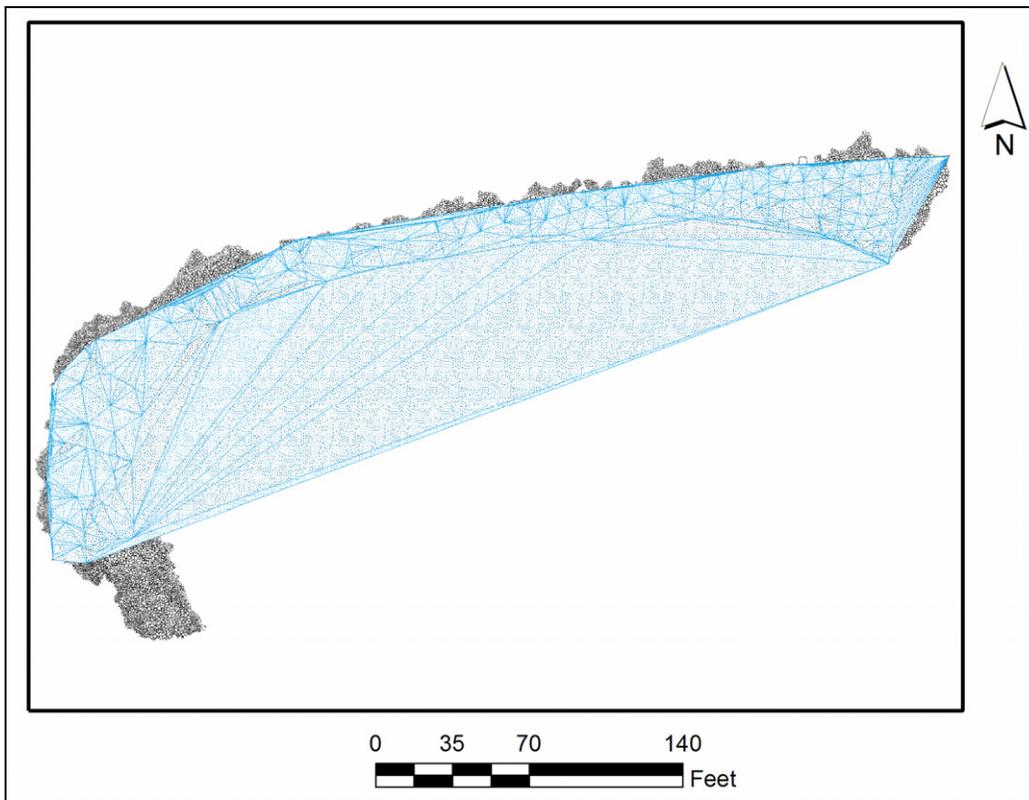


Figure 30. TIN model of the standing wall (non-conservative) overlaid onto the planimetric site map.

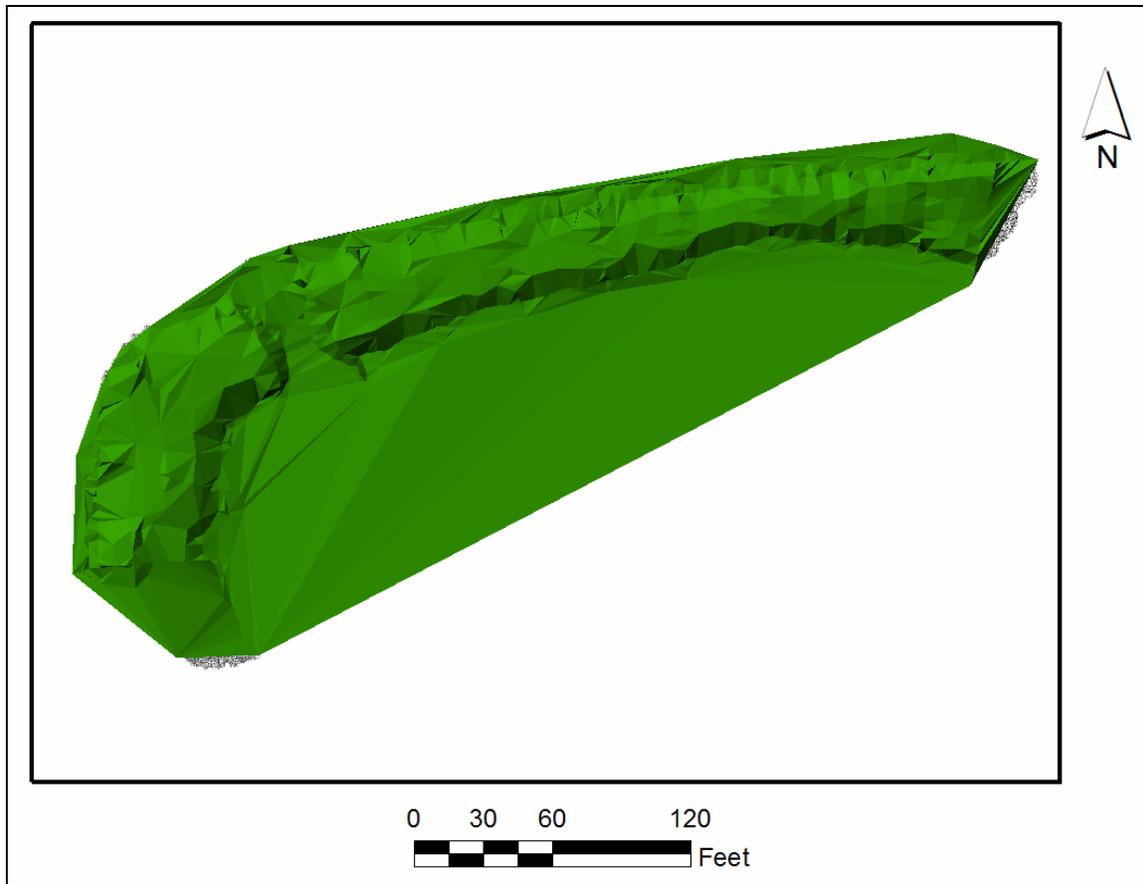


Figure 31. TIN model of the entire wall structure, including both the standing wall and associated rubble scatter.

TIN model resolution is a function of the data point density used to create the model. While the 3D models accurately reflect the data used to create them, in areas where data points were not densely collected, accuracy of the TIN model declined. Areas with insufficient modeling data included the pond side of the wall and the break in the wall where it was difficult to differentiate between standing wall and displaced rubble. The error in modeling occurred in the break section of the TINs rendered to model the standing wall where

more volume of standing wall was modeled than actually exists. A fourth TIN was created and used to correct for error created in the cut section where the point density was insufficient.

After the 3D model creation, the surface volume of each TIN could be calculated in ArcGIS. The total volume of displaced material was calculated from overlaying the standing wall TINs on the total wall TIN, with error added to the difference (Figure 32 and Table 1).

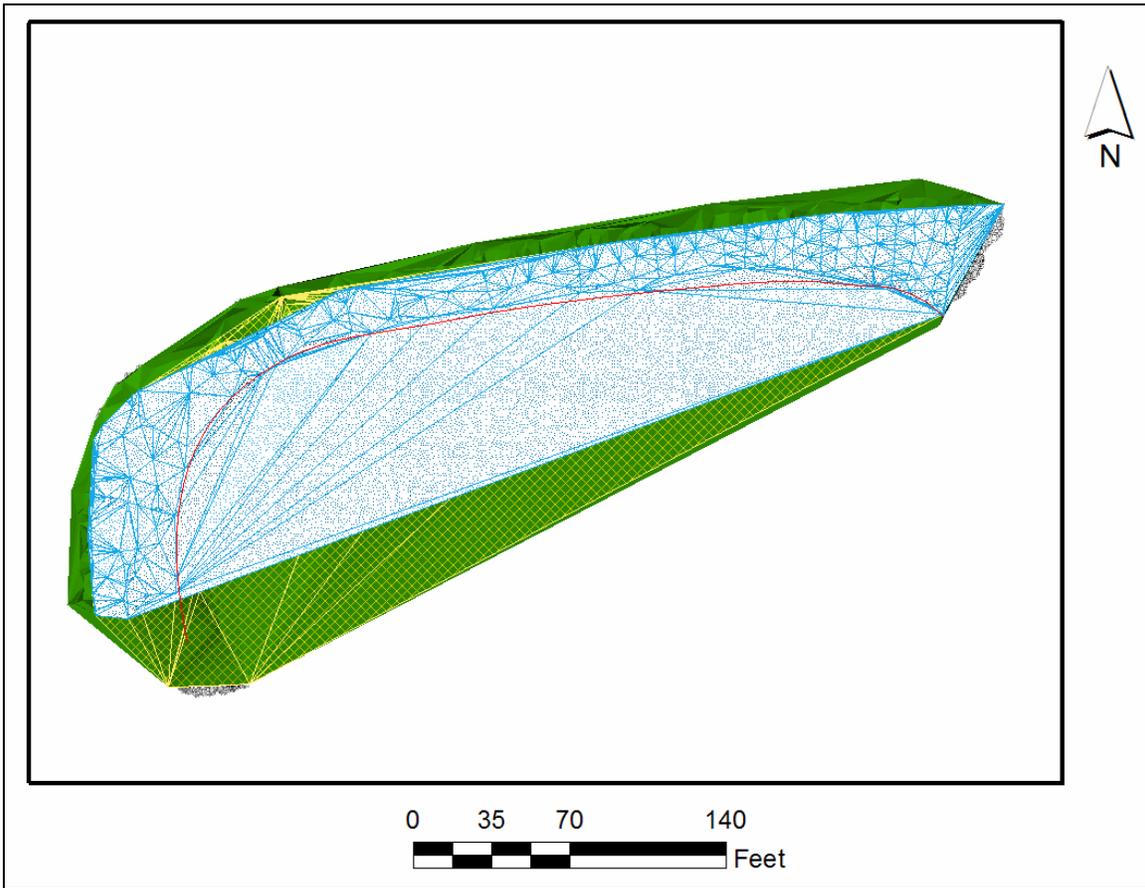


Figure 32. The standing wall TINs (yellow and blue) overlaid on the total wall TIN (green). The difference in volume represents the amount of displaced material.

<b>Total Wall Volume</b>		8,950.43 m <sup>3</sup>	11,706.72 yd. <sup>3</sup>	316,081.45 ft. <sup>3</sup>
<b>Standing Wall Volume</b>	Conservative	8,679.33 m <sup>3</sup>	11,352.14 yd. <sup>3</sup>	306,507.6 ft. <sup>3</sup>
	Non-conservative	5,386.36 m <sup>3</sup>	7,045.09 yd. <sup>3</sup>	190,217.5 ft. <sup>3</sup>
<b>Displaced Wall Volume</b>	Conservative	271.1 m <sup>3</sup>	354.59 yd. <sup>3</sup>	9,573.81 ft. <sup>3</sup>
	Non-conservative	3,564.07 m <sup>3</sup>	4,661.63 yd. <sup>3</sup>	125,863.9 ft. <sup>3</sup>

Table 1. Wall Volume Data

## CONCLUSIONS

Using a combination of methods including GPS, photographic documentation, and hand mapping, the SRC and KAHO park staff successfully documented the 'Ai'ōpio Fishtrap in Kaloko-Honokōhau National Historical Park. An overall scaled plan-view drawing of the fishtrap represents compiled GPS data, photographic imagery, and field descriptions from fishtrap documentation. The scaled plan view shows the current condition of the wall including the break in the wall and some reconstructed portions near the

eastern wall terminus. In addition to the overall plan, the team used baseline trilateration to document the break section in detail, creating a scaled plan view indicating the location and relationship of the base stones visible in the cut section. The team also hand-mapped two intact sections of the ocean-side of the fishtrap wall creating two scaled profile drawings showing wall construction techniques that might be useful in future reconstruction efforts. Also, using GPS data and field descriptions, the team produced 14 cross

sections along the wall's length indicating the changing shape of the wall from the eastern terminus across the wall to the western terminus.

In addition to the graphics produced from the documentation and data analysis of the 'Ai'ōpio Fishtrap, 3D modeling and spatial analysis of GPS data in a GIS project enabled calculation of various wall volumes. The total volume of rock, including standing wall and debris, was calculated based on a 3D TIN model using all points collected on the wall. Two additional TIN models were created to assess the amount of intact wall, both conservatively based on field data collections, and less conservatively based on extrapolations from analyzed field data. The 3D models made it possible to calculate an estimated volume of material displaced from the intact wall structure.

The current condition of the 'Ai'ōpio Fishtrap reveals a considerable amount of material

displaced from the original fishtrap structure due to wall fall along the perimeter and removal of portions of the wall to allow canoe access. The original goal of the 'Ai'ōpio Fishtrap project was to document the current state of the wall. As documentation progressed, the documentation goals included consulting with the park on the impact of the wall rehabilitation project for consideration by the State Historic Preservation Officer. Based on results from the archaeological documentation and ArcGIS analysis, there do not appear to be significant historical or archaeological materials that will be negatively affected by an 'Ai'ōpio Fishtrap rehabilitation project. Consequently, the SRC recommends that a finding of “no adverse effect” to historical and/or archaeological materials be attached to the wall rehabilitation project.

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